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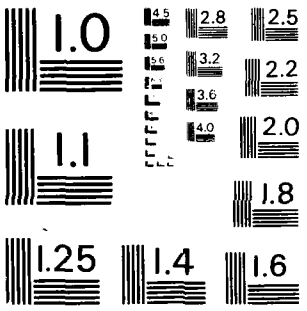

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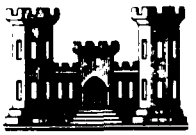
CONNECTICUT COASTAL BASIN

EAST HAVEN-BRANFORD, CONNECTICUT

LAKE SALTONSTALL DAM
CT 00115

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS. 02154

AUGUST, 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: CT 00115	2. GOVT ACCESSION NO.: AD-A143 054
	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): Conn. Coastal Basin East Haven-Branford, Conn., Lake Saltonstall Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS	5. TYPE OF REPORT & PERIOD COVERED: INSPECTION REPORT
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254	12. REPORT DATE: August 1979 13. NUMBER OF PAGES: 70
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,
Conn. Coastal Basin
East Haven-Branford, Conn.
Lake Saltonstall Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is an earthfill structure with an upstream masonry and concrete retaining wall. The top of the dam is approx. 80 ft. in width at the spillway and 20 ft. above the streambed of the Farm River Diversion. The top of the dam is approx. 100 ft. long along the upstream edge of the crest and approx. 200 ft. long along the downstream edge of the crest, as shown on sheet B-1. The test flood will be equivalent to the PMF. Peak inflow to the reservoir is 7450 cfs; peak outflow is 1900 cfs with the dam overtopped, 1.9 ft. Based on our hydraulic computations, the spillway capacity is 220 cfs.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

NOV 28 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

Inclosed is a copy of the Lake Saltonstall Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, New Haven Water Company, New Haven, Connecticut 06511.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

CONNECTICUT COASTAL BASIN

EAST HAVEN-BRANFORD, CONNECTICUT

LAKE SALTONSTALL DAM
CT 00115

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST, 1979

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	LAKE SALTONSTALL DAM
Inventory Number:	CT-00115
State Located:	CONNECTICUT
County Located:	NEW HAVEN
Town Located:	EAST HAVEN-BRANFORD
Stream:	DIVERSION OF FARM RIVER
Owner:	NEW HAVEN WATER COMPANY
Date of Inspection:	MAY 2, 1979
Inspection Team:	PETER M. HEYNEN, P.E.
	CALVIN GOLDSMITH
	MIRON PETROVSKY
	GEORGE STEPHENS
	NORMAN PALUBA

The dam is an earthfill structure with an upstream masonry and concrete retaining wall. The top of the dam is approximately 80 feet in width at the spillway and 20 feet above the streambed of the Farm River Diversion. The top of the dam is approximately 100 feet long along the upstream edge of the crest and approximately 200 feet long along the downstream edge of the crest, as shown on sheet B-1 in the appendix. U.S. Route 1, a four lane highway, runs along the top of the dam. The spillway consists of a 10 foot wide by 4.2 foot high opening in the upstream masonry wall for the enclosed concrete ogee weir which feeds a 36" x 58" corrugated metal arch culvert through the embankment. The arch culvert connects to a junction box, as does the 24 inch low level outlet pipe, which runs from a concrete intake chamber 10 feet upstream of the upstream face of the dam. A 48 inch reinforced concrete pipe discharges from the junction box to the downstream streambed at the toe of the dam.

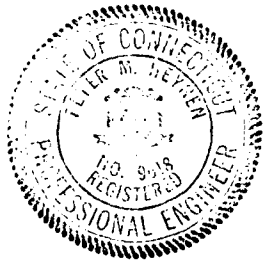
Based upon the visual inspection at the site and past performance, the dam is judged to be in fair condition. No evidence of structural instability was observed, however surface sloughing and erosion of the downstream embankment slope was noted.

Based on the size (Intermediate) and hazard classification (High) of this dam determined in accordance with Corps of Engineers Guidelines, the test flood will be equivalent to the Probable Maximum Flood (PMF). Peak inflow to the reservoir is 7450 cfs; peak outflow is 1900 cfs with the dam overtopped 1.9 feet. Based on our hydraulic computations, the spillway capacity is 220 cfs, which is equivalent to 12% of the routed test flood outflow.

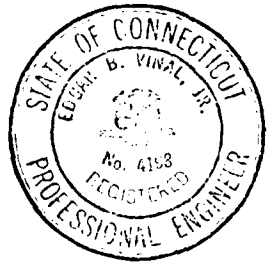
It is recommended that further studies by a qualified professional engineer be initiated by the owner to perform a more refined hydraulic/hydrologic study to determine the spillway capacity and overtopping potential. Recommendations should be made by the engineer and implemented by the owner to increase the project discharge based upon the refined hydraulic/-hydrologic study.

The above recommendations, and any required remedial measures, are discussed in Section 7 and should be instituted within 2 years of the owner's receipt of this report.

Peter M. Heynen, P.E.
Project Manager
Cahn Engineers, Inc.



Edgar B. Vinal, Jr., P.E.
Senior Vice President
Cahn Engineers, Inc.



This Phase I Inspection Report on **Lake Saltonstall Dam** has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph W. Finegan

JOSEPH W. FINEGAN, JR., MEMBER
Water Control Branch
Engineering Division

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, CHAIRMAN
Chief, Structural Section
Design Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam would necessarily represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as neccessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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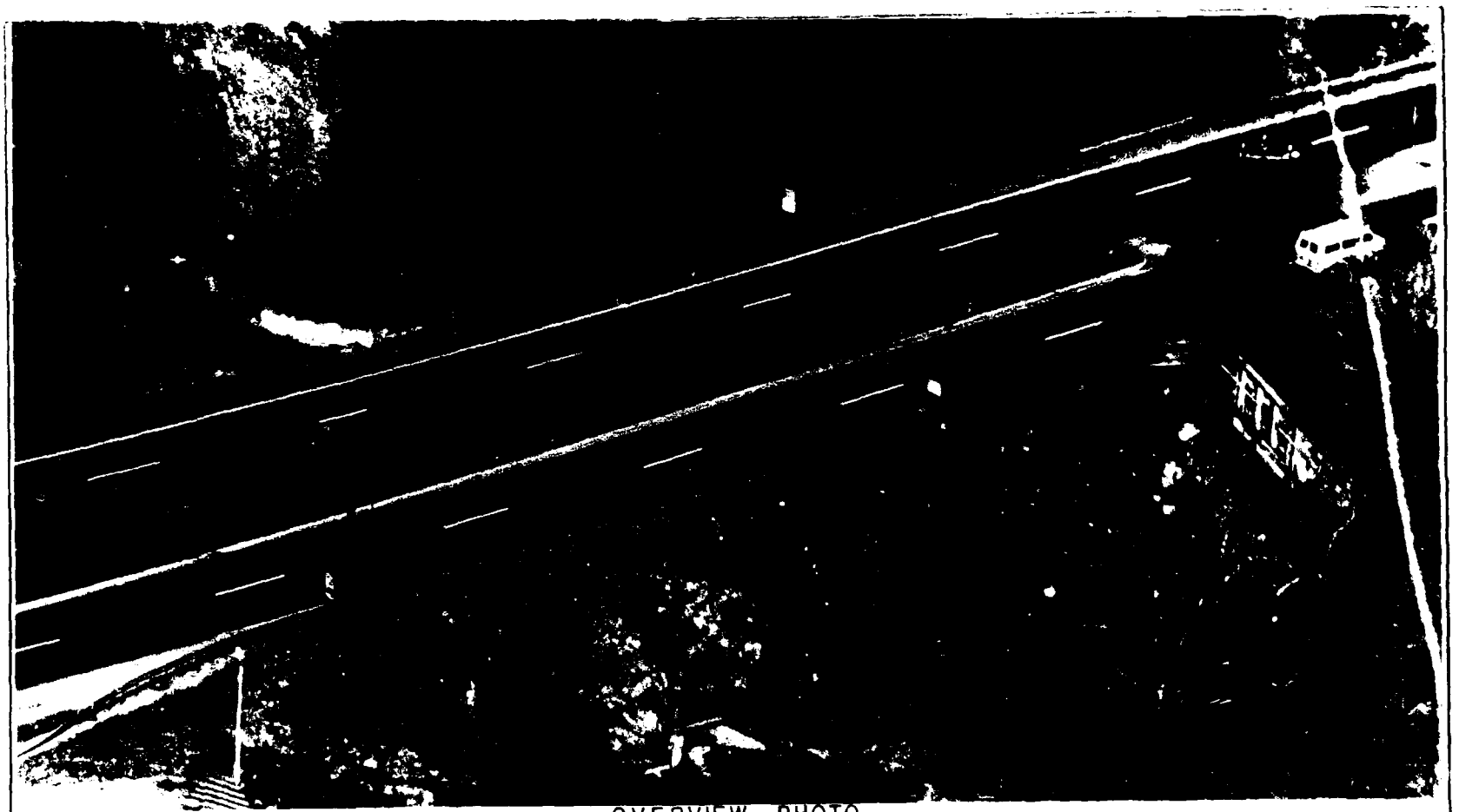
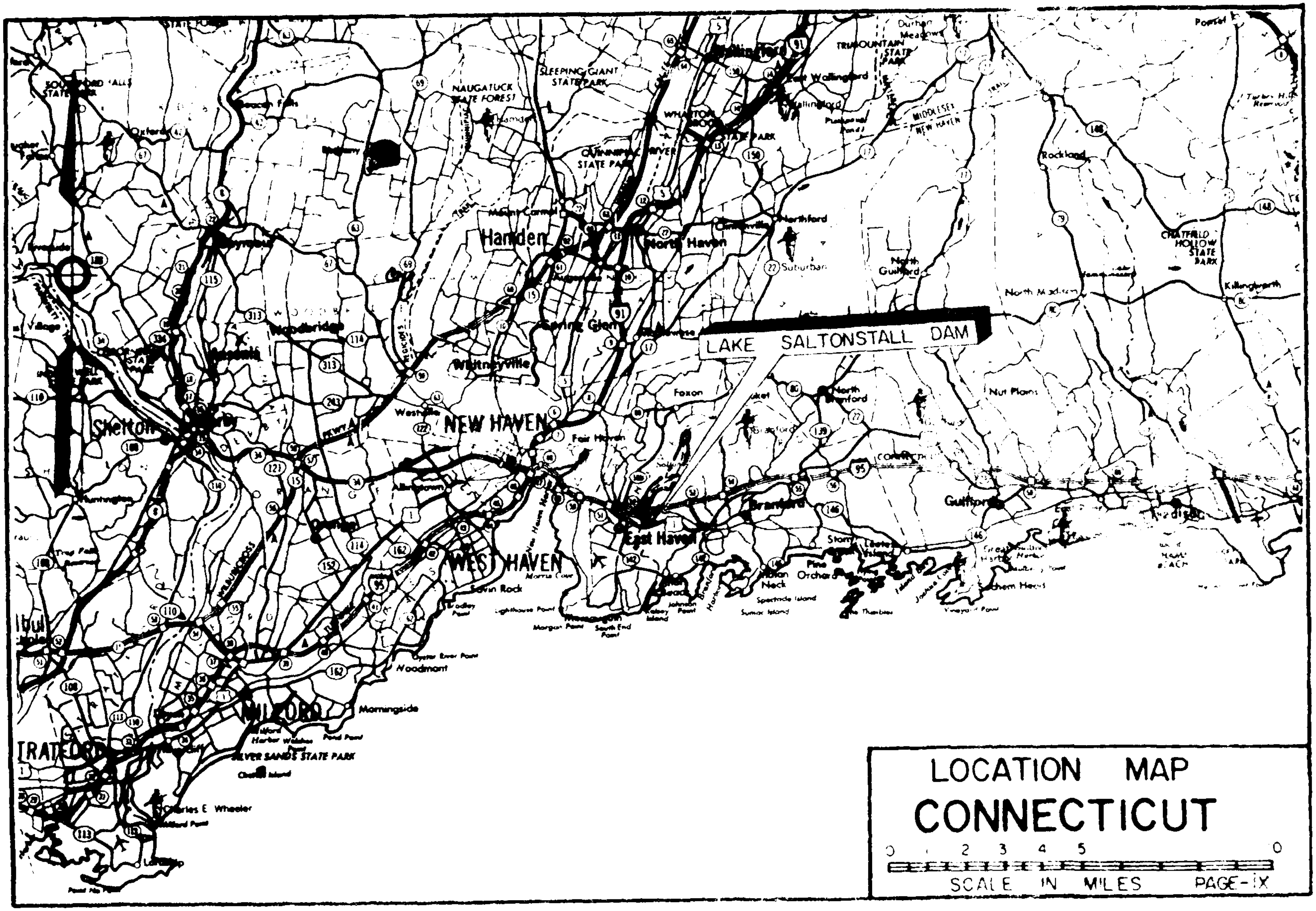


OVERVIEW PHOTO

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	LAKE SALTONSTALL DAM	EAST HAVEN BRANFORD	DATE March '79
CAHN ENGINEERS INC WALLINGFORD, CONN ENGINEER	INSPECTION OF NON-FED DAMS	TR. FARM RIVER	CONNECTICUT	CE # 27 660 KA PAGE VIII


LAKE SALTONSTALL DAM
NEW HAVEN
WEST HAVEN
East Haven
Hamden
North Haven
Whitneyville
Spring Glen
Fair Haven
Foxon
Branford
Guilford
North Branford
Northford
North Guilford
North Madison
Nut Plains
Rockland
Killingworth
CHATFIELD HOLLOW STATE PARK
SLEEPING GIANT STATE PARK
NAUGATUCK STATE FOREST
TRIMOUNTAIN STATE PARK
Durham Meadows
MIDDLESEX NEW HAVEN
Wallingford
East Wallingford
Mount Carmel
Shelton
Huntington
Oxford
Woodbridge
Westville
Allingtown
Orange
Savin Rock
Morris Cove
Lighthouse Point
Morgan Point
South End Point
Stony Creek
Pine Orchard
Indian Neck
Spectacle Island
Sumac Island
Sachem Head
Woodmont
Oyster River Point
Morningside
MILFORD
SILVER SANDS STATE PARK
Charles E Wheeler
STRATFORD
LOCATION MAP
CONNECTICUT
0 1 2 3 4 5 0
SCALE IN MILES
PAGE-IX

PHASE I INSPECTION REPORT

LAKE SALTONSTALL DAM

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of March 30, 1979 from John P. Chandler, Colonel, Corps of Engineers. Contract No. DACW 33-79-3-0059 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

3. To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program - The scope of this Phase I inspection report includes:

1. Gathering, reviewing and presenting all available data as can be obtained from the owners, previous owners, the state and other associated parties.

2. A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

3. Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

4. An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features of the dam which need corrective action and/or further study.

1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on a diversion of the Farm River in a suburban area of the Towns of Branford and East Haven, County of New Haven, State of Connecticut. The dam is shown on the Branford USGS Quadrangle map as having coordinates latitude N 41° 16.9' and longitude W 72° 51.7'.

b. Description of Dam and Appurtenances - The earthfill dam is approximately 100 feet long at the upstream face and approximately 200 feet long at the downstream face, with a top width of approximately 80 feet at the spillway section. The dam was originally built wide enough to accommodate a two lane road along its crest. In 1928, the road was widened to 4 lanes, necessitating a widening of the crest of approximately 18 feet. Improvements to the 4 lane road in the early 1940's resulted in a widening of the crest of the dam to its present width which now accommodates the 4 lanes of U.S. Route 1. The upstream face of the dam is a vertical concrete and masonry wall in which the spillway is set. The spillway is a 10 foot long by 4.2 foot high concrete enclosed ogee section discharging to a 36 inch x 58 inch corrugated metal arch pipe culvert leading to a junction box in the downstream portion of the highway embankment. The low level outlet is a 24 inch cast iron pipe which also discharges to the junction box. A 48 inch diameter reinforced concrete culvert discharges to the streambed at the downstream toe of the dam from the junction box. The spillway crest is at elevation 22.1, 5 feet below the top of the dam, while the low level outlet intake is at elevation 13.3, 13.8 feet below the top of the dam. The ungated spillway has a bar screen across the intake to serve as a trash rack. The low level outlet is regulated by a hand operated gate on the concrete intake chamber 10 feet upstream of the dam.

The downstream face of the dam is an earth fill roadway embankment at an inclination of 2 horizontal to 1 vertical, and is somewhat protected against erosion by a growth of grass and weeds.

c. Size Classification - INTERMEDIATE - The dam impounds 6700 acre-feet of water with the level at the top of the dam, which at elevation 27.1, is 25± feet above the stream bed. According to the Recommended Guidelines, this dam is classified as intermediate in size

d. Hazard Classification - HIGH - The dam is located immediately upstream (500 ft.) of 3 low lying houses and a trolley museum which would be in the path of a flood outflow caused by a breach of the dam. Further downstream about one mile after passing through some marshland, there is another urban area with at least 5 low lying houses along the Farm River near Short Beach Road.

e. Ownership - New Haven Water Co.
90 Sargent Drive
New Haven, Connecticut 06511
Mr. Jack Reynolds (203) 624-6671

f. Operator - Mr. James Creaser
New Haven Water Company
(203) 469-5309

g. Purpose of Dam -Public water supply

h. Design and Construction History - According to a plaque on the dam dated 1655, a dam on this site was used to provide power to Connecticut's third iron works plant. The exact date of construction of the dam in its present form is not known, however specifications for its construction are noted as being from 1882. Post-construction changes to the dam consisted primarily of changes in the width of the roadway across the dam. The two lane road was widened to a four lane road in 1928 which necessitated extending the low level outlet and spillway outlet pipes some 18 feet to clear the widened roadway embankment. The embankment was widened an undetermined amount again in the early 1940's to accommodate improvements of the 4 lane highway.

In 1949, the low level outlet valve at the upstream face of the dam was inoperable, and was replaced with the present gated concrete intake chamber approximately 10 feet upstream of the dam.

In 1960, the present concrete spillway was constructed, and the 36 inch by 58 inch corrugated metal arch pipe was constructed under the highway to replace the two smaller pipes which previously carried the spillway flow but collapsed in May 1, 1959. A junction box was installed in the embankment to route flow from the spillway culvert and the low level outlet pipe to a 48 inch reinforced concrete discharge pipe. At this time, the upstream masonry facing of the dam was raised with concrete 2 feet to its present elevation.

i. Normal Operational Procedures - The low level outlet valve is normally opened about 40 turns of a possible 200± to keep water flowing in Furnace Pond, that part of Lake Saltonstall immediately upstream of the dam. The filtration plant for the public water supply is located upstream of the dam on the west shore of Lake Saltonstall, and draws water from the reservoir as needed.

1.3 PERTINENT DATA

a. Drainage Area - 3.92 square miles of rolling terrain.

b. Discharge at Damsite - Discharge is through a 24 inch low level outlet, and through a 58" x 36" metal arch culvert downstream of the concrete spillway weir. It is conceivable that discharge through the outlet conduit could be somewhat reduced by unusually high tide conditions during large storms.

1. Outlet Works:	24 inch low level outlet at Invert Elevation 8.4 - Invert of concrete intake Elevation 13.3 Spillway conduit 58" by 36" corrugated metal arch pipe culvert at Invert Elevation 17.4
2. Maximum known flood at damsite:	Unknown
3. Ungated spillway capacity @ top of dam elevation 27.1:	220 cfs.
4. Ungated spillway capacity @ test flood elevation:	N/A
5. Gated spillway capacity @ normal pool elevation:	N/A
6. Gated spillway capacity @ test flood elevation:	N/A
7. Total spillway capacity @ test flood elevation:	N/A
8. Total project discharge @ test flood elevation 29.0:	1900 cfs.

c. Elevations - (Feet Above Mean Sea Level = MHW +2.83)

1. Streambed at centerline of dam:	$2^{\pm}$
2. Maximum tailwater:	N/A
3. Upstream portal invert diversion tunnel:	N/A-Tunnel discharges to canal
4. Recreation pool:	N/A

5. Full flood control pool:	N/A
6. Spillway crest:	22.1
7. Design surcharge (original design):	N/A
8. Top of dam:	27.1
9. Test flood design surcharge:	29.0

d. Reservoir

1. Length of maximum pool:	Approx. 5 miles
2. Length of recreation pool:	N/A
3. Length of flood control pool:	N/A

e. Storage

1. Recreation pool:	N/A
2. Flood control pool:	N/A
3. Spillway crest pool:	4700 acre - ft.
4. Top of dam:	6900 acre-ft.
5. Test flood pool:	7700± acre-ft.

f. Reservoir Surface

1. Recreation pool:	N/A
2. Flood control pool:	N/A
3. Spillway crest:	388 acres
4. Test flood pool:	430+ acres
5. Top of dam:	430 acres

g. Dam

1. Type:	Earthfill with upstream masonry and concrete face
2. Length:	100± ft. upstream 200± ft. downstream
3. Height:	25± ft.
4. Top width:	80± ft. at spillway

5. Side slopes:	Vertical (Upstream) 2H to 1 V (Downstream)
6. Zoning:	N/A
7. Impervious Core:	N/A
8. Cutoff:	Not known
9. Grout curtain:	N/A
10. Other:	N/A

h. Diversion and Regulating Tunnel

1. Type:	Diversion tunnel unlined in rock, otherwise concrete and brick conduit-discharges to a canal leading to Lake Salton-stall. Minimum Diameter 5".
2. Length:	2000± ft.
3. Closure:	N/A
4. Access:	N/A
5. Regulating Facilities:	Gated at upstream tunnel entrance

i. Spillway

1. Type:	Concrete ogee weir to 58" to 36" culvert
2. Length of weir:	10 ft.
3. Crest elevation:	22.1
4. Gates:	None
5. Upstream Channel:	8' deep maximum Vertical dam face
6. Downstream Channel:	Natural streambed
7. General:	58" x 36" arch culvert discharges to 48 inch pipe at junction box in embankment.

j. Regulating Outlets

1. Invert:	Intake chamber opening el. 13.3; 24" pipe invert el. 8.4
2. Size:	[illegible] inch diameter
3. Description:	Cast iron pipe
4. Control Mechanism:	Hand wheel lift
5. Other:	Intake in concrete chamber 10' upstream of dam.

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Available Data - The available data consists of correspondence from New Haven Water Company and State of Connecticut personnel, and deals primarily with the dam in conjunction with the roadway. A publication concerning the Lake Saltonstall Tunnel diversion written by Edward E. Minor was also obtained, as well as other assorted pieces of data from the owner and the State of Connecticut.

b. Design Features - The available data indicates the design features stated herein.

c. Design Data - There were no engineering values, assumptions, test results or calculations available for the original construction. Information was available pertaining to the redesign of the spillway in 1959, and is included in Appendix B.

2.2 CONSTRUCTION

a. Available Data - No information is available on the actual construction of the dam itself, however as-built drawings for the outlet works are available, and as-built drawings encompassing the dam are available for the present configuration of U.S. Route 1 (See List of Existing Plans, Appendix B).

b. Construction Considerations - No information was available other than the above-mentioned as-built drawings obtained from the owner and the Sate of Connecticut Highway Department.

2.3 OPERATIONS

Lake level readings are taken daily. To our knowledge, the dam has not been overtopped. No other formal operations records are known to exist.

2.4 EVALUATION

a. Availability - Existing data was provided by the owner, and by the State of Connecticut. The owner made the facility available for visual inspection.

b. Adequacy - The limited amount of detailed engineering data available was generally inadequate to perform an in-depth assessment of the dam, therefore, this assessment of the dam must be based primarily on visual inspection, performance history, hydraulic computations and approximate hydrologic judgements.

c. Validity - A comparison of record data and visual observations reveals no observable significant discrepencies in the record data.

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. General - The general condition of the dam is fair. Inspection revealed some areas requiring maintenance and attention. The reservoir level was at elevation 22.2, 4.9 feet below the top of the dam at the time of our inspection, and the weather was sunny, warm and dry.

b. Dam

Crest - The crest of the earthfill dam accomodates U.S. Highway 1 (Photo 1). No misalignment of the crest was observed. Several cracks across the top were noted in the highway pavement which were most likely formed due to traffic loads.

Upstream Face - The upstream face of the dam is a 2 foot wide and 60+ foot long masonry stone wall with cement mortar joints. The wall has a 2 foot wide and 2 foot high new concrete cap which was installed in 1960. The facing generally is in good condition. However, there were observed open joints in the left side of the wall, cracking in the mortar, and separating of distinct stones with 1/2 to 1 inch wide cracks between them near the water level (Photo 2). Several vertical 1/16 to 1/8 inch wide cracks were discovered in the corners of the concrete cap.

Downstream Slope - The downstream earth slope of the dam with an inclination of approximately 2 horizontal to 1 vertical is covered with tall grass and some brush. Two erosion ditches up to 1 to 2 foot deep and 2 to 3 feet wide were observed along the left side of the downstream slope at a distance of 30± and 60± feet from the concrete outlet, respectively (Photo 5). Because of the absence of a barrier, the downstream slope has numerous signs of trespassing, as well.

Very slight seepage spots were revealed on the downstream toe near the right side at a distance of 10 to 20 feet from the concrete culvert outlet. A substantial wet area on the heavy grass cover is located below the seepage spots. A small flow leads from the wet area to the outlet channel. The formation of this wet area could be caused due to seepage both through the dam foundation and the surrounding downstream area.

Spillway - The new cast-in-place reinforced concrete spillway built in 1960 has a 10 foot by 4.2 foot opening with a bar screen trash rack with bars spaced approximately every 2 inches (Photo 3). There was flow over the spillway during the inspection and hence it could not be observed completely. Spalling and cracking of the concrete were noted on the left side of the spillway and at the right headwall adjacent to the spillway (Photo 3). Due to the location of the deteriorated concrete, it appears that the damage was caused by freeze-thaw cycles.

c. Appurtenant Structures - The spillway discharge outlet culvert is a 36 inch by 58 inch arch corrugated metal pipe installed under the highway in 1960. The conduit could not be examined

The concrete intake chamber is a concrete wet well with an intake opening to the 24 inch low level outlet pipe, which is connected to the junction box in the downstream portion of the highway embankment. There is a wooden plank service bridge between the chamber and the upstream face of the dam (Photo 2). At the downstream toe, there is a concrete low level outlet headwall, which exhibits deterioration of concrete particularly on the outlet wingwalls. This deterioration includes exposed aggregate, spalling, and a loss of the design shape due to the erosion of the wingwalls (Photo 5).

d. Reservoir Area - The reservoir area is bordered on the north and the northeast by a ridge. The area surrounding the reservoir is wooded and undeveloped, except at the south end along U.S. Route 1. The reservoir has an inlet diversion aqueduct from a tunnel from the Farm River, which enters the lake at the extreme north end.

Upstream of the dam, a railroad embankment crosses the lake and acts as a constriction through which water from the upstream portion of the lake must pass to reach the dam (Photo 4). The culvert through the embankment is a semi-circular arch with a 5' radius.

e. Downstream Channel - The downstream channel itself is in a fairly natural condition with a gravel and boulder bottom and trees and brush on its banks (Photo 6).

3.2 EVALUATION

Based upon the visual inspection, it was possible to assess the dam as being generally in fair condition.

The following features which could influence the future condition and/or stability of the dam were identified.

1. Concrete of the spillway, low level outlet service bridge abutment, the upstream stone masonry and concrete facing, and the downstream concrete headwall and wingwalls, is cracked and spalled, and will deteriorate more rapidly in the future if not repaired.

2. Downstream slope erosion will also increase with time, and will lead to gradual undermining of the roadway.

3. The seepage at the toe of the dam could develop into problem seepage in the future if not corrected or monitored.

4. The trash rack in front of the spillway opening would be blocked very easily by floating debris, because the bars are spaced only 2 inches on center.

SECTION 4: OPERATIONAL PROCEDURES

4.1 REGULATORY PROCEDURES

Lake level readings are taken daily. The 24 inch low level outlet is normally opened about 45 turns of a possible 200± to maintain the flow of water in the stream and in the lake upstream of the dam. The filtration plant for the public water supply draws water from the reservoir from upstream of the dam as needed.

4.2 MAINTENANCE OF DAM

Little maintenance was evident on that portion of the dam downstream of U.S. Route 1. Trap rock had been placed on the downstream slope where sloughing had occurred. The road along the crest is maintained by the State of Connecticut. The upstream face of the dam has some deterioration of the masonry and concrete, but otherwise appears to be fairly well maintained.

The New Haven Water Company three years ago instituted a yearly inspection program encompassing all their dams. The inspections are performed by a consultant qualified in the field of dam inspection.

4.3 MAINTENANCE OF OPERATING FACILITIES

The low level outlet valve was well greased and appeared to be well-maintained. The owner removes debris from the spillway bar screen periodically.

4.4 DESCRIPTION OF ANY FORMAL WARNING SYSTEM IN EFFECT

No formal warning system exists for this dam.

4.5 EVALUATION

The operational and maintenance procedures are generally fair. The downstream face of the dam should be maintained regularly.

A formal program of operation and maintenance procedures should be implemented, including documentation to provide complete records for future reference. Also, a formal warning system should be developed and implemented within the frame indicated in Section 7.1c. Remedial operation and maintenance recommendations are presented in Section 7.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. General - Lake Saltonstall dam and reservoir is generally a high storage - low spillage water supply facility.

The Lake Saltonstall watershed includes a tunnel diversion from the Farm River drainage area, which can be controlled by gates at the tunnel inlet, according to the New Haven Water Company. During large storms, the diversion tunnel inflow to Lake Saltonstall could be eliminated, and therefore it will not be considered as contributing to the peak inflow for the purposes of our computations.

Approximately 0.3 miles upstream of the dam, Lake Saltonstall is crossed by a railroad embankment with a stone masonry culvert. This crossing divides the lake's watershed and restricts flow from the upper, major portion of the lake to the lower portion and the dam. The embankment will significantly restrict the peak inflow to the dam. However, this is a man-made structure, and its ability to withstand a differential head is unknown, and as the embankment could be removed at any time, our analysis will assume the embankment to have been removed. The performance of Lake Saltonstall Dam at Test Flood conditions was analyzed without the attenuating effect of the railroad embankment.

b. Design Data - Information was available pertaining to the redesign of the spillway and discharge conduit in 1959. A letter dated September 11, 1959 by John J. Mozzochi and Associates to the State of Connecticut reviewed the sizing of the spillway as it presently exists based upon two different analyses of the hydrology of the project. A subsequent letter from John J. Mozzochi and Associates dated January 11, 1960 documents a meeting with the New Haven Water Company and their consultant, Clarence Blair and Associates, during which the New Haven Water Company agreed to raise the proposed top of the dam one foot to elevation 27.1 to provide 2 feet rather than only one foot of freeboard for the design storm. This correspondence is included in Appendix B.

c. Experience Data - In May of 1959, it was discovered that the outlet pipes under the roadway had been crushed and blocked completely by the settling embankment fill, which resulted in a 4 foot deep hole under the highway pavement. This situation precipitated the new spillway design and subsequent construction in 1960. The dam has reportedly not been overtopped, at least since the construction of the new spillway.

d. Visual Observations - The bar screen and the enclosed spillway weir and conduit configuration could be easily subject to blockage.

Further, more severe sloughing of the downstream slope in the vicinity of the discharge conduit could result in partial or complete obstruction of the outlet works.

e. Test Flood Analysis - The test flood for this high hazard, intermediate size dam is equivalent to the Probable Maximum Flood (PMF). Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March, 1978, peak inflow to the reservoir is 7450 cfs (Appendix "D-3"); peak outflow is 1900 cfs with the dam overtopped 1.9 feet (Appendix "D-13"). Based upon our hydraulics computations, the spillway capacity is 220 cfs, which is approximately 12% of the routed Test Flood outflow at the top of dam, elevation 27.1.

f. Dam Failure Analysis - Utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", the peak failure outflow from the dam breaching would be 12,000 cfs. At the 3 low lying houses in the initial impact area, a breach of the dam would result in flooding due to a rise in the water level of 8.7 feet, which corresponds to an increase in the water level from a depth of approximately 2.3 feet just before the breach to a depth of 11.0 feet just after the breach. Impact areas further downstream would be reached by flows which could be somewhat retarded by a railroad embankment downstream of the initial impact area.

SECTION 6: STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation - The visual inspection did not disclose any indications of structural stability problems. There was cracking and spalling of the concrete spillway, service bridge abutment, masonry wall cap and low level outlet headwall and wingwalls. There were also several substantial cracks in the upstream stone masonry facing, and substantial erosion on the downstream slope of the dam, as described in Section 3.

b. Design and Construction Data - The design and construction data is not sufficient to permit an in-depth analysis of the stability of the dam.

c. Operating Records - The operation records do not include any indications of dam instability from its construction around 1882 and subsequent modifications in 1949, and up to 1959. It was in 1959 that the spillway discharge culvert collapsed partially, causing a 4 foot deep hole in the highway pavement. The culvert was subsequently replaced with the existing arch culvert.

d. Post Construction Changes - The widening of the roadway along the top of the dam in 1928, and in the early 1940's resulted in the widening of the dam embankment, which would tend to increase the stability of the dam, provided the material used to construct the additional embankment width adjacent to the downstream face of the dam is more pervious than the material used to construct the original embankment. The nature of the materials used in the original construction and the subsequent additions was not determined, therefore the actual effect on the stability of the dam cannot be ascertained.

Reconstruction of the intake for the 24 inch low level outlet and the redesign of the spillway in 1949 and 1960, respectively, would tend to provide the increases in dam stability normally associated with improved outlet capacity.

The raising of the masonry upstream facing with concrete in 1960 is not sufficient to appreciably lessen the dam stability, and actually will serve to indirectly increase the dam stability by increasing the freeboard and decreasing the chances of overtopping of the dam during storms.

e. Seismic Stability - The dam is in Seismic Zone 1, and according to the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection of the site and its past performance, the dam appears to be in fair condition. No evidence of structural instability was observed in the dam or its appurtenances. The embankment is generally in fair condition with areas of erosion on the downstream slope. Other areas requiring attention include the project discharge capacity and the maintenance problems. More detailed recommendations and remedial measures are presented in Section 7.2 and 7.3, respectively.

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharge" dated March, 1978, peak inflow to the reservoir is 7450 cubic feet per second; peak outflow is 1900 cubic feet per second with the dam overtopped 1.9 feet. Based upon our hydraulics computations, the spillway capacity is 220 cubic feet per second, which is equivalent to approximately 12% of the routed Test Flood outflow.

b. Adequacy of Information - The information available is such that an assessment of the condition and stability of the dam must be based solely on visual inspection, past performance of the dam, and sound engineering judgement.

c. Urgency - It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within one year of the owner's receipt of this report.

d. Need for Additional Information - There is a need for more information as recommended in Section 7.2.

7.2 RECOMMENDATIONS

1. Based upon the computations in Appendix "D", the dam spillway capacity will be exceeded by the Test Flood. More sophisticated flood routing should be undertaken by hydrologists/hydraulics engineers to refine the spillway design flood figures. A study should be undertaken to determine the spillway capacity and potential for overtopping. Recommendations should be made by the engineer and implemented by the owner to increase the project discharge capacity based upon the refined spillway design flood figures.

7.3 REMEDIAL MEASURES

a. Operation and Maintenance Procedures - The following measures should be undertaken within the time frame indicated in Section 7.1c, and continued on a regular basis.

1. Round-the-clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of an emergency.

2. A formal program of operations and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

3. The New Haven Water Company has instituted a yearly program of technical inspection of all their dams, including Lake Saltonstall Dam, by an engineer qualified in the field of dam inspection. This program, which has been in effect for 3 years, should be continued and should include the operation of all outlet facilities.

4. The relatively minor cracking and spalling of the concrete of the spillway, service bridge abutment and outlet retaining wall, as well as the cracks in the stone masonry facing, should be repaired.

5. Sloughing of the downstream slope should be repaired and appropriate measures taken to prevent further slope failures. Consideration should be given to the installation of a fence around the downstream slope and toe of the dam to prevent trespassing which has caused erosion problems on the downstream slope. Cutting of grass of the downstream slope and the toe should be performed regularly as part of the routine dam maintenance.

6. The area of seepage at the downstream toe near the right side of the dam should be monitored periodically for increases in seepage flow.

7. The gates at the inlet to the diversion tunnel from the Farm River should be closed as part of the formal operational procedures to be followed during major storms.

8. Consideration should be given to installing a log boom upstream of the spillway inlet to minimize blockage of the spillway outlet. Also, consideration should be given to increasing the spacing of the trash rack bars so as to minimize the chances of blockage.

7.4 ALTERNATIVES

This study has identified no practical alternatives to the above recommendations.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Lake Saltonstall Dam

DATE: May 2, 1979

TIME: 11:00 AM

WEATHER: Sunny, 70°F

W.S. ELEV. 22.2 U.S. ____ DN.S

PARTY:	INITIALS:	DISCIPLINE:
1. Peter M. Heynen	PMH	CAHN ENGINEERS, INC.
2. CALVIN GOLDSMITH	CG	CAHN ENGINEERS, INC.
3. MIRON PETROVSKY	MP	CAHN ENGINEERS, INC
4. GEORGE STEPHENS	GS	CAHN ENGINEERS, INC.
5. Norman PALUBA	NP	NEW HAVEN WATER CO.
6.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	EARTH DAM EMBANKMENT	PMH, CG, MP	
2.	CONCRETE INTAKE CHAMBER	PMH, CG, MP, GS, NP	
3.	CONCRETE SPILLWAY	PMH, CG, MP, GS	
4.	CONCRETE OUTLET HEADWALL	PMH, MP	
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

PERIODIC INSPECTION CHECK LIST

PROJECT LAKE SALTONSTALL DAM DATE 4/24/2, 197?

PROJECT FEATURE EARTH DAM EMBANKMENT BY PMH, CG, MP

AREA EVALUATED		CONDITION
EMBANKMENT		
Crest Elevation		27.1
Current Pool Elevation		22.2±
Maximum Impoundment to Date		NOT KNOWN
Surface Cracks		NONE OBSERVED
Pavement Condition		Good, SOME CRACKING
Movement or Settlement of Crest		NONE OBSERVED
Lateral Movement		NONE OBSERVED
Vertical Alignment		NONE OBSERVED
Horizontal Alignment		NONE OBSERVED
Condition at Abutment and at Concrete Structures		Good
Indications of Movement of Structural Items on Slopes		NONE OBSERVED
Trespassing on Slopes		FOOTPATHS
Sloughing or Erosion of Slopes or Abutments		Major EROSION of D/S SLOPE
Rock Slope Protection-Riprap Failures		Cracking & SPALLING of U/S CONCRETE AND MASONRY WALL
Unusual Movement or Cracking at or Near Toes		NONE OBSERVED
Unusual Embankment or Downstream Seepage		Slight seepage AND WET AREA AT Right side OF TOE
Piping or Boils		NONE OBSERVED
Foundation Drainage Features		N/A
Toe Drains		
Instrumentation System		

PERIODIC INSPECTION CHECK LIST

PROJECT LAKE SALTONSTALL DAM DATE May 3, 1979

PROJECT FEATURE CONCRETE INTAKE CHAMBER BY PMH, CG, MP, GS, NP

AREA EVALUATED	CONDITION
INTAKE WORKS-CONTROL TOWER	
A) Concrete and Structural	
General Condition	Good
Condition of Joints	NONE OBSERVED
Spalling	
Visible Reinforcing	
Rusting or Staining of Concrete	
Any Seepage or Efflorescence	
Joint Alignment	
Unusual Seepage or Leaks in Gate Chamber	
Cracks	
Rusting or Corrosion of Steel	
B) Mechanical and Electrical	
Air Vents	N/A
Float Wells	
Crane Hoist	
Elevator	
Hydraulic System	
Service Gates	24" GATE VALVE operated by HAND WHEEL
Emergency Gates	
Lightning Protection System	N/A
Emergency Power System	
Wiring and Lighting System	

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Saltonstall Dam DATE May 2, 1979

PROJECT FEATURE Concrete Outlet Headwall BY PMH, MP

AREA EVALUATED		CONDITION
OUTLET WORKS-OUTLET STRUCTURE AND OUTLET CHANNEL		
General Condition of Concrete		POOR
Rust or Staining		NONE OBSERVED
Spalling		SOME CRACKING AND SPALLING
Erosion or Cavitation		EROSION OF WINGWALLS WITH EXPOSED AGGREGATE AND LOSS OF DESIGN SHAPE
Visible Reinforcing		NONE OBSERVED
Any Seepage or Efflorescence		
Condition at Joints		
Drain Holes		
Channel		
Loose Rock or Trees Overhanging Channel		NONE OBSERVED
Condition of Discharge Channel		GOOD

PERIODIC INSPECTION CHECK LIST

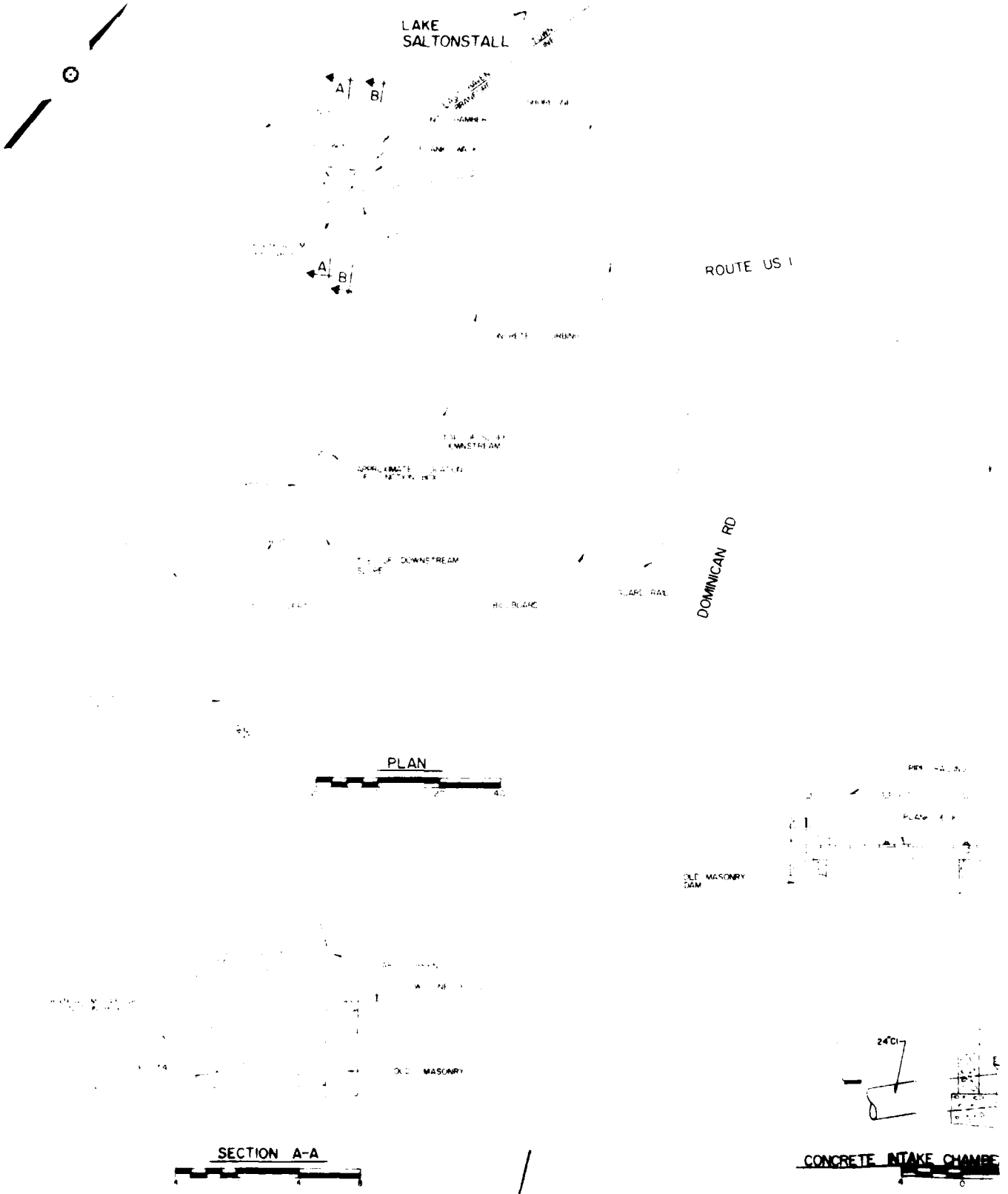
PROJECT LAKE SALTONSTALL DAM DATE MAY 2, 1979

PROJECT FEATURE CONCRETE SPILLWAY BY PMH, CG, MP, GS

AREA EVALUATED	CONDITION
1. OUTLET WORKS-SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a) Approach Channel	
General Condition	NOT KNOWN
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b) Weir and Training Walls	
General Condition of Concrete	GOOD
Rust or Staining	NONE OBSERVED
Spalling	SOME DETERIORATION NEAR WATER LEVEL
Any Visible Reinforcing	NONE OBSERVED
Any Seepage of Efflorescence	
Drain Holes	N/A
c) Discharge Channel	
General Condition	GOOD
Loose Rock Overhanging Channel	NONE OBSERVED
Trees Overhanging Channel	SOME TREES
Floor of Channel	SOME SILTY SAND, GRAVEL & STONE
Other Obstructions	

APPENDIX B

ENGINEERING DATA AND CORRESPONDENCE


LAKE
SALTONSTALL
A
B
A
B
ROUTE US 1
DOMINICAN RD
PLAN
OLD MASONRY DAM
OLD MASONRY
SECTION A-A
24"Ø
CONCRETE INTAKE CHAMBE

PROFILE ON CENTER LINE OF CULVERT

0 0 10 20

NOTES

CRETE INTAKE CHAMBER - SECTION B-B

DAMS ENGINEERING BR. ENGINEER	ARMY ENGINEER DIV. NEW ENGLAND DIV. ENGINEER WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

PLAN PROFILE AND SECTIONS

LAKE SALTONSTALL DAM

TR- FARM RIVER EAST HAVEN, BRANFORD, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
JJ	JMC	RWH	DATE JUNE 979	SHEET 8

LAKE SALTONSTALL DAM

LIST OF EXISTING PLANS

"Plan Showing Land to be Acquired From New Haven
Water Co. By The State of Connecticut,
Intersection of Routes 1 and 1A."
William J. Cox, Highway Commissioner
July, 1941

"Lake Saltonstall Drainage Improvement,
Design #3," (With hydrologic data)
(New Haven Water Co. Proposal)
Sept., 1959

"New Haven Water Co.,
Lake Saltonstall Proposed Spillway."
Clarence Blair Assc., Inc.
Dec., 1959

"New Haven Water Co.,
Lake Saltonstall Spillway, As Built."
Clarence Blair Assc., Inc.
Dec., 1960

SUMMARY OF DATA AND CORRESPONDENCE

DATE	TO	FROM	SUBJECT	PAGE
June 15, 1973	Files	Water Resources Commission Supervision of Dams	Inventory data	B-4
Aug. 12, 1974	Files	New Haven Water Co.	Statistics on Dams	B-5
June 19, 1959	Newman E. Argraves State Highway Commissioner State Highway Department	Joseph A. Novaro Chief Engineer New Haven Water Co.	Notification of damage to blowoff pipe	B-8
June 19, 1959	F. J. Callahan General Manager New Haven Water Co.	Joseph A. Novaro	Instructions concerning damaged blowoff pipe	B-9
June 26, 1959	Joseph A. Novaro	W. T. Schuler, Chief, Construction and Maintenance, Conn. State Highway Dept.	Acknowledgement of damage to blowoff pipe	B-10
Aug. 26 1959	Robert A. Norton, Hydraulics Engineer Conn. Highway Dept.	T.H. Sellew, Asst. Chief of Design	Summary of proposed repairs and modifications to spillway	B-11
Aug. 27, 1959	William S. Wise, Director, Water Resources Comm.	Robert A. Norton	Request for issuance of permit to perform modifications	B-12
Aug. 28, 1959	John J. Mozzochi, Consulting Engineer	Merwin E. Hupfer	Request to review design data	B-13
Aug. 31 1959	Water Resources Commission	Robert A. Norton	Application for construction permit	B-14

DATE	TO	FROM	SUBJECT	PAGE
Sept. 11, 1959	William S. Wise	John J. Mozzochi	Review of design data; recommendation for issuance of construction permit	B-15
Dec. 11, 1959	Emitt A. Dell, Water Resources Commission	Roger C. Brown, Clarence Blair Assc., Inc.	Spillway modification data	B-16
Dec. 22, 1959	Water Resources Commission	Joseph A. Novaro	Application for construction permit for spillway modification	B-17
Jan. 11, 1960	William S. Wise	John J. Mozzochi	Review of spillway hydraulic data; recommendation for issuance of construction permit	B-18
Dec. 5, 1960	William S. Wise	John J. Mozzochi	Recommendation for issuance of final approval	B-20
Jan. 4, 1961	New Haven Water Co.	William S. Wise	Certificate of approval	B-21

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

Acng 72-510.7
Lat 41-16.9

Inventoried by JT

Date 6/15/73

Name of Dam or Pond Lake Saltonstall Dam

Code No. EH2

Nearest Street Location Rt 1

Town East Haven

U.S.G.S. Quad. Branford

Name of Stream East Haven River

Owner New Haven Water Co.

Address 100 Crown St.
New Haven

ok
7/13

DA 3.92 SM

Pond Used For Water supply storage

Dimensions of Pond: Width 1000± Length 5 mile Area 368 acres

Total Length of Dam 120' Length of Spillway 10'

Location of Spillway

Height of Pond Above Stream Bed 10'

Height of Embankment Above Spillway 4'

Type of Spillway Construction CONCRETE

Type of Dike Construction MASONRY

Downstream Conditions

Summary of File Data

Remarks

Would Failure Cause Damage? Class

NEW HAVEN WATER COMPANY

STATISTICS ON DAMS*

NAME Saltonstall

SUPPLY SYSTEM Saltonstall

LOCATION East Haven - Branford

DATES: ORIGINAL CONSTRUCTION

ADDITIONS, ALTERATIONS 1949; 1960

	MEAN HIGH WATER ELEVATION	LENGTH
CREST**	24.3	92± Ft.
TOP OF CORE WALL		
SPILLWAY	19.3	10 Ft.
B. O. AXIS	6.52	
BED OF RIVER	4±	
DEEPEST FOUNDATION		

FREEBOARD: CREST TO SPILLWAY 5 Ft.

CREST TO TOP OF CORE WALL

HEIGHT: CREST TO BED OF BROOK 20± Ft.

CREST TO DEEPEST FOUNDATION

TYPE Earth with Stone Facing

TOP WIDTH--MAX. BOTTOM WIDTH (Ft.)

UPSTREAM SLOPE H/V Vertical

DOWNSTREAM SLOPE H/V

TRIBUTARY WATERSHED (Square Miles) 13.8

RESERVOIR AREA (Acres) 388.4

RESERVOIR TOTAL STORAGE (MG)

RESERVOIR USABLE STORAGE (MG) 1500

*See individual sheets for more details
**Crest Length includes spillway

Date 8/12/74

NEW HAVEN WATER COMPANY

Pg 1.
DATE Aug. 1974

JAME OF DAM SALTONSTALL

TYPE
Earth embankment with stone masonry facing on upstream side of dam. Downstream embankment now incorporated in to the highway embankment of U.S. Highway No. 1. Concrete spillway discharging into a 36" x 58" corrugated arch pipe under surface of highway which connects to a large concrete drainage structure in southern portion of highway embankment. See Map 90133

LOCATION
On the north side of U.S. Highway No. 1 (Boston Post Road) at the East Haven - Branford Town Line

See U.S.G.S. BRANFORD QUADRANGLE MAP

SUPPLY SYSTEM SALTONSTALL

ATE OF CONSTRUCTION
ORIGINAL 1882 - earth dam with rubble stone corewall & 24" Blowoff p.
OTHER 1949 - blowoff gate valve at face of dam no longer operable. It was replaced with a new valve located in a concrete chamber several feet upstream from face of dam with access by a bridge. See map file 40060 for plans.

1960 - New concrete spillway constructed and masonry facing of dam raised with concrete to elevation 24.3 M.H.W. New 36"x58" corrugated metal pipe installed under highway replacing two small pipes that formerly carried the spillway flow. See map files 90133 & 90132

NGINEER
1882 Phineas E. Ball
1949 Clarence Blair Assoc. Inc
1960 Clarence Blair Assoc. Inc.

7. CONTRACTOR
Worcester, Mass. (N.H. Water Co)
New Haven Water Co
New Haven Water Co.

	ELEVATION	LENGTH (Feet)	MISC.
CREST	24.3 M.H.W	± 92	
SPILLWAY	19.3 "	10	
AXIS OF B.O	6.52 at B.O. valve	chamber	24" B.O.
BED OF RIVER	± 4 M.H.W.		
EEPEST FNDN.			

84 08 27 233

B-6

NEW HAVEN WATER COMPANY

SALTONSTALL DAM.

DATE

13. HEIGHT FROM BED OF BROOK ± 20 Feet

HEIGHT FROM DEEPEST FOONDATION Feet

15. TOP WIDTH Part of highway width Feet

16. MAXIMUM WIDTH AT BOTTOM Feet

UPSTREAM SLOPE Vertical Stone Masonry Face

18. DOWNSTREAM SLOPE

19. FREE BOARD - SPILLWAY TO CREST 5 Feet

- SPILLWAY TO TOP OF COREWALL Feet

. MISC. DATA

Pumping Station established in 1882

Note: See specifications in this file for an earth dam with rubble stone wall within the earth embankments at outlet of Lake Saltonstall.

21. WATERSHED TRIBUTARY TO:

UPSTREAM DAMS Farm River Div. Dam via Saltonstall Tunnel 11.1 Sq. Mi.

THIS DAM 2.7 Sq. Mi.

TOTAL WATERSHED TRIBUTARY TO THIS DAM 13.8 Sq. Mi.

2. RESERVOIR AREA AT FLOW LINE 388.4 Acres

23. RESERVOIR CAPACITY AT FLOW LINE Mil. Gal.

4. RESERVOIR USABLE CAPACITY (~~To lowest outlet~~) Top 15 ft. 1500 Mil. Gal

5. UPSTREAM DAMS

None

6 DOWNSTREAM DAMS

None

June 19, 1959

Mr. Newman E. Argraves,
State Highway Commissioner,
State Highway Department,
P. O. Box 2188,
Hartford, Conn.

Dear Sir:

We are writing about a most urgent matter which requires prompt action.

The spillway overflow from our Lake Saltonstall dam adjacent to Route No. 1 at the East Haven-Branford Town Line is carried under the State Highway embankment by drainage pipes installed at the time the highway was built. In May we discovered that these pipes had been crushed from above and completely blocked by embankment fill settling into the space formerly occupied by these pipes. The settlement created a 4-foot deep hole under the highway pavement. We made an inspection with highway engineers on May 15th.

With the spillway discharge completely blocked a most dangerous situation has been created. We are attempting to control storm runoff by operating the 24" blowoff pipe under the dam. However, this is totally inadequate for large storm runoff. If a very large storm should occur the dam and adjacent highway embankment can be topped. Failure of the highway embankment would release about a billion and a half gallons of water downstream, with severe property loss and possible loss of life.

We have had further discussions and meetings with your local office and officials at your Wethersfield Office and they are familiar with the situation.

In view of the dangerous situation that exists it is imperative that every effort be made to expedite the engineering and reconstruction of these drainage facilities.

Yours very truly,
NEW HAVEN WATER COMPANY

Joseph A. Novaro
Chief Engineer

Certified Mail
Copy to Mr. Bowerman

June 19, 1959

Mr. F. J. Callahan,
General Manager.

Dear Sir:

In view of the dangerous situation which exists at Lake Saltonstall I would suggest that in addition to operating the blow-off pipe, the Saltonstall Tunnel be shut down to eliminate that large watershed from Lake Saltonstall and that it be operated only in the event Saltonstall needs major replenishing.

It might be well also to supply Mr. Stokes with a quantity of sand bags in the event a heavy storm arrives, so that Harry could sandbag the top of the dam to prevent overflow. I believe also that Harry should be fully advised of this dangerous situation and given complete instructions as to procedure to take and who to notify.

Yours very truly,
NEW HAVEN WATER COMPANY

Joseph A. Novaro
Chief Engineer

STATE OF CONNECTICUT

STATE HIGHWAY DEPARTMENT

24 WOLCOTT HILL ROAD . . . . . WETHERSFIELD

P.O. BOX 218 . . HARTFORD 15, . . . CONNECTICUT

June 26, 1959

In reply please
refer to Unit #501

New Haven Water Company
100 Crown Street
New Haven 6, Connecticut

Attention: Joseph A. Novaro, Chief Engineer

Gentlemen:

This will acknowledge your letter of June 19, 1959 and our subsequent meeting of June 24, 1959 concerning the condition of the blow-off outlet from your Lake Saltenstall dam adjacent to Route #1, and also the drainage pipe carrying the overflow from the spillway.

Considering the urgency of the situation relative to the replacement of the blow-off pipe, the Department will upon conclusion of a satisfactory agreement with the New Haven Water Company, incorporate the installation of the blow-off pipe in the proposed contract for the replacement of the culvert pipes. We will also do everything possible to expedite the engineering necessary.

It is my understanding that your engineering consultant will present your construction requirements, as they effect the installation of your blow-off pipe, to our District Engineer in order that these requirements may be incorporated in the plans.

Very truly yours,

Newman E. Argraves
State Highway Commissioner

By _____
W. T. Schuler
Chief - Construction and Maintenance

c
o
p
y

Project No. 43-63
Drainage on Route U.S. 1 at Lake Saltonstall
East Haven & Branford

8-26-59

Mr. R. A. Norton

T. H. Sellew

Forwarded herewith are prints of the preliminary plans and hydraulic data for the above project. Please review the hydraulic characteristics of the proposed overflow and make the necessary applications for a permit for the modification of the existing dam and for approval of waterway to the Water Resources Commission.

The modifications to the existing dam consist of the removal of a 12 foot section, 5 feet deep, of the existing wet masonry dam, the rebuilding of any adjacent sections which may be loosened or weakened in the process, and the installation of a cast-in-place reinforced concrete spillway which will have a 10 foot by 3 foot opening with a bar screen. According to the SOILS investigation, there was no masonry encountered in a test hole bored 6 feet from the face of the dam, so it is considered to be a masonry faced earth dam. Accordingly, we are proposing no excavation closer than a 1:1 slope line from the water surface except where protected by sheet piling which will be left in place.

The 10 ft. by 3 ft. opening with bar screen was proposed by the New Haven Water Company. With the worst conditions, assuming no water drawn from the reservoir by that company, a rise of approximately 2.3 feet in the water surface can be expected.

This will not, apparently, cause flooding of any property other than that of the water company and will leave a free board of approximately 2 feet at the dam.

Please secure approval and permits as soon as possible. This project is scheduled for advertising as soon as completed.

/s/ T.H. Sellew - J.M.

Assistant Chief - Design

AJT:ama
Attach.
CC - Mr. D. S. Johnson
Mr. T. H. Sellew
Mr. H. T. Davidson
Central Files

8-27-59

Mr. William [illegible] Wise — [illegible] Resources Commission

Robert A. Norton — Highway

Proposed Culvert - Route U.S. 1 at Outlet of Lake Saltonstall
Towns of East Haven and Branford - Project 63-63

Forwarded herewith are preliminary design and hydraulic data for the replacement of the culvert under Route U.S. 1 at the outlet of Lake Saltonstall in East Haven and Branford. Also included is a memorandum of explanation from Mr. T. H. Bellew dated 8-26-59. One set of the preliminary plans, hydraulic data and memorandum was delivered to Mr. C. J. Pelletier on 8-26-59.

The proposed work includes the replacement of the culvert and also a modification of the spil way of the dam to improve the inlet conditions to the culvert. Since this dam is located within the highway right-of-way, permit for the modification of the dam is being requested by the Highway Department.

It is requested that you review the proposed structure for conformance with waterway requirements which you may establish for this stream. It is also requested that you issue a permit for the modification of the dam contingent upon the approval of the Highway Department's plan by the New Haven Water Company.

The existing culvert has partially collapsed and it is urgent that the replacement be made as soon as possible since the embankment around the culvert may settle, causing the road to become impassable.

Robert A. Norton
Hydraulics Engineer

Attach.
RAN:ll

August 26, 1959

Mr. John J. Mozzochi, Consultant Engineer
265 Hebron Avenue
Glastonbury, Connecticut

Code No. L38.1, EH3.1

Dear Mr. Mozzochi:

We are enclosing preliminary plans, hydraulic data and correspondence relative to the proposed alterations to Lake Saltonstall Dam in the Towns of East Haven and Branford. This dam, owned by the New Haven Water Company, is located on State Highway Department property.

Under your contract as a consultant to this Commission, will you kindly perform the work indicated at your earliest possible convenience as this project appears to be most urgent.

Very truly yours,

Marvin E. Hupfer
Senior Sanitary Engineer

MEH:gd

Encls.

FORM D-4

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
Room 317, State Office Building
Hartford, Connecticut

RECEIVED
SEP 1 [illegible]
State Water Resources Commission

APPLICATION FOR CONSTRUCTION PERMIT FOR DAM

Owner New Haven Water Co. Date Aug. 31, 1959

P. O. Address 100 Crown St.
New Haven, Conn. Tel. No. MAin 4-9803

Location of Structure:

Town Branford & East Haven Shown on USGS Quadrangle Branford, Conn.

Name of Stream Outlet, Lake Saltonstall at 3.75 inches ~~south~~ north of Lat. 41°-15'
and 1.45 inches east of Long. 72°-52'-30"
~~west~~

Directions for reaching site from nearest village or route intersection:
(see sketch on reverse side)

Route U.S. 1 on Branford-East Haven Town Line

This is an application for: ~~(New Construction)~~ (Alteration) ~~(Repair)~~ ~~(Removal)~~
(check one or more of above)

This pond is to be used for: Water Supply

Dimensions of Pond: width 1,200 ft. length 16,000 ft. area 430 acres

Maximum depth of water immediately above dam: 8 ft.

Total length of dam: 80 ft.

Length of spillway: See attached plan

Height of abutments above spillway: "

Type of spillway construction: "

Type of dike construction: "

Spillway section will be set on: (Bedrock) (Gravel) (Clay) (Till)
(check one of above)

Remarks: Dam owned by New Haven Water Co. Located on State of Connecticut Right-of-Way U.S. 1. See memo dated 8-27-59

Signed: Robert A. Norton (owner)

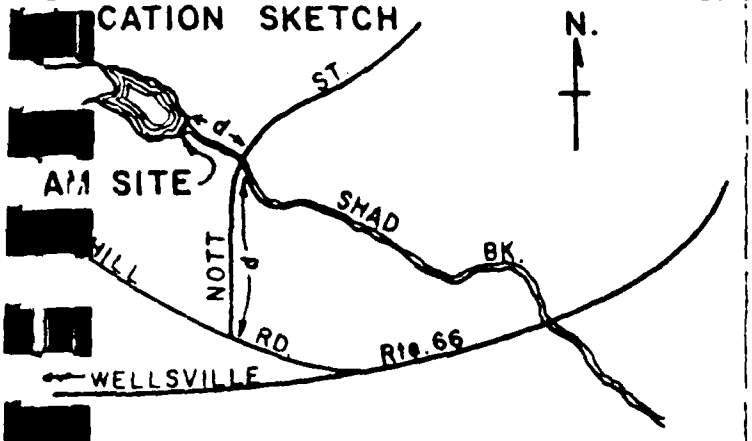
Name of Engineer, if any Robert A. Norton
Hydraulics Engineer
Connecticut State Highway Department

Note: Show details of construction on reverse side.

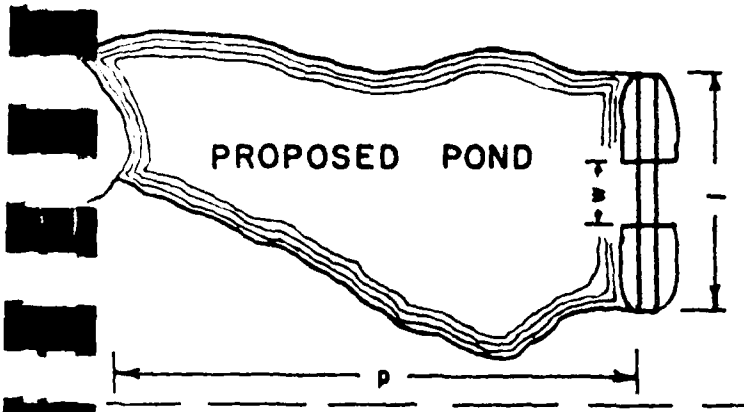
B-14

SAMPLE DATA

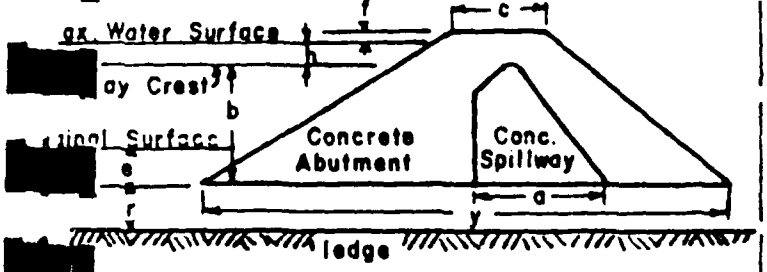
LOCATION SKETCH



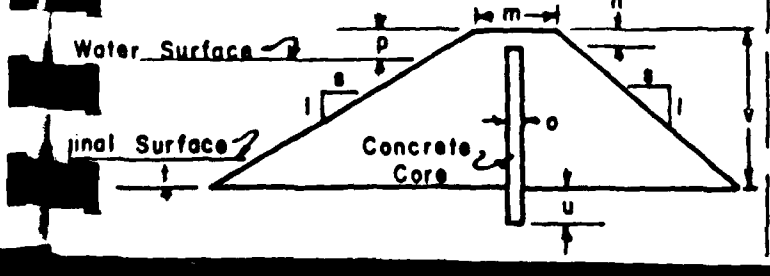
SITE PLAN



SPILLWAY SECTION



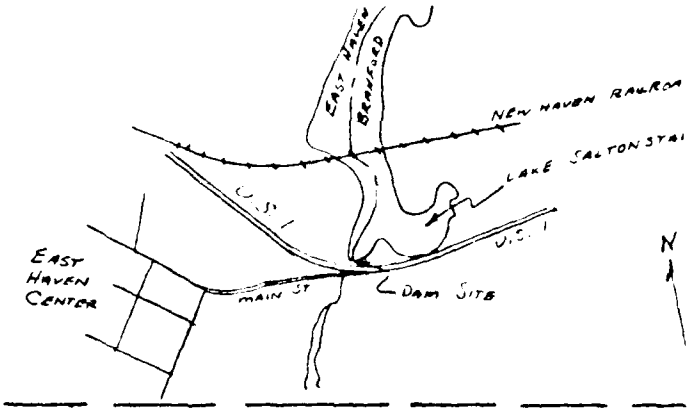
DIKE SECTION



APPLICANT'S DATA

Show only features of sample which are applicable and dimensions which reflect your infor

LOCATION SKETCH



SITE PLAN

SPILLWAY SECTION

NOTE...
If there are two methods of discharge Show Bo

DIKE SECTION

JOHN J. MOZZOCHI AND ASSOCIATES
CONSULTING ENGINEERS

JOHN J. MOZZOCHI
ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.

217 HEBRON AVENUE
GLASTONBURY, CONN.
PHONE MEDFORD 3-9401

September 11, 1959

William S. Wise - Director
State Water Resources Commission
State Office Building
Hartford 15, Connecticut

CODE NO. L 38.1, EH 3.1

Re: Our File 57-73-23
Towns of East Haven and Branford
Alterations to Lake Saltonstall Dam

Dear Mr. Wise:

In accordance with your authorization dated August 28, 1958, I have reviewed the design and hydrology data on the above referenced project and find them to be substantially correct.

Two methods of approach in determining the correctness of the spillway opening were used:

(1) A design storm of 15" with 13.5" runoff having a duration of 6 hrs was routed to the pond area of the watershed. Computations show that at the peak of this storm the depth of water going over the spillway would be approximately 1 ft.

(2) Mean annual run off, for the drainage area, using Bigwoods formula was computed. Using a factor of 5 times the mean annual flood and with storms having durations of 1 hr; 4 hr; 8 hr; and 12 hr, depths of water going over the spillway were computed. These showed depths of 0.3 ft; 1.0 ft; 2.1 ft and 2.8 ft. The 12 hr storm would reduce the freeboard to 1.5 ft. However, a storm of this magnitude is well beyond the range of a 300 year storm.

Based on our computations, we recommend that a construction permit be issued for this project.

We are retaining the hydrology computations in our files.

Very truly yours,

John J. Mozzochi and Associates
Consulting Engineers

JJM:hk

ROGER C. BROWN
AMES C. BEACH
FRANK RAGAINI

CHARLES E. AUGUR, JR.
GORDON BILIDES
JOHN M. BREST
DONALD L. DISBROW
NICHOLAS PIPERAS, JR.

CLARENCE BLAIR ASSOCIATES, INC.

Civil Engineers

P. O. BOX 236 SPRUCE 7-7379
93 WHITNEY AVENUE — NEW HAVEN CONN

WATER SUPPLY
SEWAGE DISPOSAL
WASTE DISPOSAL
SURVEYS
LAND DEVELOPMENT

December 11, 1959

State of Connecticut
Water Resources Commission
State Office Building
Hartford 15, Connecticut

Attention: Mr. Emitt A. Dell

Gentlemen:

Enclosed is a plan showing proposed changes in the spillway of the dam at the New Haven Water Company's Lake Saltonstall in the Towns of Branford and East Haven. The Water Company intends to make these changes in conjunction with the Connecticut State Highway Department's Drainage Improvement Project No. 43-63.

The Highway Department made application to your office for a construction permit for this project on September 18, 1959 and received a permit dated August 31, 1959.

Under the present plans, the Highway Department's project would terminate just south of the dam and the Water Company would be responsible for the construction pertaining to the dam itself as shown on the enclosed plan.

The New Haven Water Company is therefore making application for a construction permit for these changes.

In addition to the change in spillway shown on the plan, the Water Company intends to add approximately one foot of concrete wall to the top of the existing masonry dam westerly of the spillway opening, bringing the top of the dam up to Elevation 26.09.

We will be glad to answer any questions or fill out forms if they are required.

Very truly yours,

CLARENCE BLAIR ASSOCIATES, INC.

Roger C Brown

Roger C. Brown

B-17

RCB:mmg
Encl.

FORM D-4

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
Room 317, State Office Building
Hartford, Connecticut

RECEIVED
DEC 24 19
State Water Resources Commission

APPLICATION FOR CONSTRUCTION PERMIT FOR DAM

Owner New Haven Water Company Date December 22, 1959

P. O. Address 100 Crown Street
New Haven, Connecticut Tel. No. MA. 4-9803

Location of Structure:

Towns East Haven and Branford Shown on USGS Quadrangle Branford 1:31680

Name of Stream East Haven River at 2.0 inches ~~south~~ of Lat. 41-17-30
and 1.5 inches ~~east~~ ~~west~~ of Long. 72-52-30

Directions for reaching site from nearest village or route intersection:
(see sketch on reverse side)

0.67 miles east of East Haven center on Route U.S. 1

This is an application for: (New Construction) (Alteration) (Repair) (Removal)
X
(check one or more of above)

This pond is to be used for: Water supply storage

Dimensions of Pond: width 1000' ± length 5 miles area 388 Acres

Maximum depth of water immediately above dam: 10 feet

Total length of dam: 120 feet

Length of spillway: 10 feet

Height of abutments above spillway: 4 feet

Type of spillway construction: See Plan

Type of dike construction: See Plan

Spillway section will be set on: (Bedrock) (Gravel) (Clay) (Till)
(check one of above)

Remarks: This is an alteration and enlargement of existing spillway. The lower part of the dam will not be disturbed.

Signed: New Haven Water Co.
Joseph A. Novak, Chief Engineer.
(owner)

Name of Engineer, if any Clarence Blair Associates, Inc.

Note: Show details of construction on reverse side.

Roger C. Brown

B-18

JOHN J. MOZZOCHI AND ASSOCIATES
CONSULTING ENGINEERS

JOHN J. MOZZOCHI
ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.

217 HEBRON AVENUE
GLASTONBURY, CONN.
PHONE MEDFORD 3-9401

January 11, 1960

Mr. William S. Wise-Director
Water Resources Commission
State Office Building
Hartford 15, Connecticut

STATE WATER RESOURCES COMMISSION
RECEIVED
JAN 12 1960
ANSWERED
REFERRED Agenda
FILED

Code No. L-38.1 EH 3.1
Our File 57-73-23
Alterations Lake Saltonstall Dam
Towns of East Haven & Branford

Dear Mr. Wise:

In accordance with instructions in letter of January 4, 1960 from Merwin E. Hupfer, I have reviewed the application from the New Haven Water Company for the referenced work.

This project is a joint proposal between the State Highway Department and the New Haven Water Company with the Highway Department installing 36 inch A.C.C.M. pipe outfall and the Water Company building the 10' x 3' spillway. Additional runoff capacity is provided by a 24" gate valve which discharges independently of the 36" A.C.C.M. pipe and is controlled by daily supervision by Water Company personnel.

With hydraulic data available, we foresee a possibility, under conditions of 12.3" runoff and no discharge through the system, of a rise in the lake level of about 3 feet. This will reduce the available freeboard to about one (1) foot.

I met Mr. Joseph Navarro, Engineer for the Water Company, and Mr. Roger Brown of Clarence Blair Associates, consultants for the Water Company at the site. They agreed to raise the proposed top of the masonry dam by an additional foot from elev. 26.09 to elev. 27.10 and thereby insure that a minimum freeboard of 2 feet will be available under the most adverse conditions.

I recommend that a construction permit be issued for the work with the condition that the top of the masonry dam be raised to a minimum elevation of 27.10.

Very truly yours,

John J. Mozzochi

John J. Mozzochi and Associates
Consulting Engineers

JJMIHk

Cert. of Appr.

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

GLASTONBURY, CONN.
817 HEBRON AVENUE
PHONE MEDFORD 3-9401

PROVIDENCE 3, R. I.
200 DYER STREET
PHONE GASPEE 1-0420

JOHN J. MOZZOCHI
ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

December 5, 1960

RECEIVED
ANSWERED
REFERRED
FILED

REPLY TO: Glastonbury

Mr. William S. Wise - Director
Water Resources Commission
State Office Building
Hartford 15, Connecticut

Re: Code No. L-38.1 EH 3.1
Our File 57-73-23
Alterations Lake Saltonstall Dam
Towns of East Haven & Branford

Dear Mr. Wise:

A final inspection was made of the referenced project today and found to be satisfactory in every detail.

Several changes from the original plans were made during construction and, by copy of this letter, I am requesting Mr. Roger Brown of Clarence Blair Associates, Engineers for the New Haven Water Company, to submit "As Built" plans for file purposes.

Since one of the changes was an increase in the size of the pipe culverts, it will be of interest to Mr. Charles Pelletier insofar as channel lines are concerned.

I recommend that a Final Permit be issued to the New Haven Water Company for this project.

Very truly yours,

John J. Mozzochi

John J. Mozzochi and Associates
Civil Engineers

JJM:hk
cc: Mr. Roger Brown
Clarence Blair Associates, Inc.

FORM D-7

STATE OF CONNECTICUT
WATER RESOURCES COMMISSION
Room 317, State Office Building
Hartford, Connecticut

CERTIFICATE OF APPROVAL

Date January 4, 1961

To: New Haven Water Company
100 Crown Street
New Haven, Connecticut

NAME OF STRUCTURE: Lake Saltonstall Dam

This is to certify that the following construction work:

Alterations to the subject dam; in accordance with "As Built" plan consisting of one sheet marked K-521B, dated December 1960 and prepared by Clarence Blair Associates, Inc; which is owned by the New Haven Water Company and is located on State Highway Department right-of-way

on your property

in the Town (s) of Branford and East Haven

for which construction permit was issued February 1, 1960, has been completed to the satisfaction of this Commission and that such structure is approved as of date of this Certificate.

WATER RESOURCES COMMISSION

BY: William S. Wise
William S. Wise, Director

Note: The owner is required by law to record this Certificate in the land records of the town or towns in which the dam, dike or similar structure is located.

cc: State Highway Department

B-21

APPENDIX C

DETAIL PHOTOGRAPHS

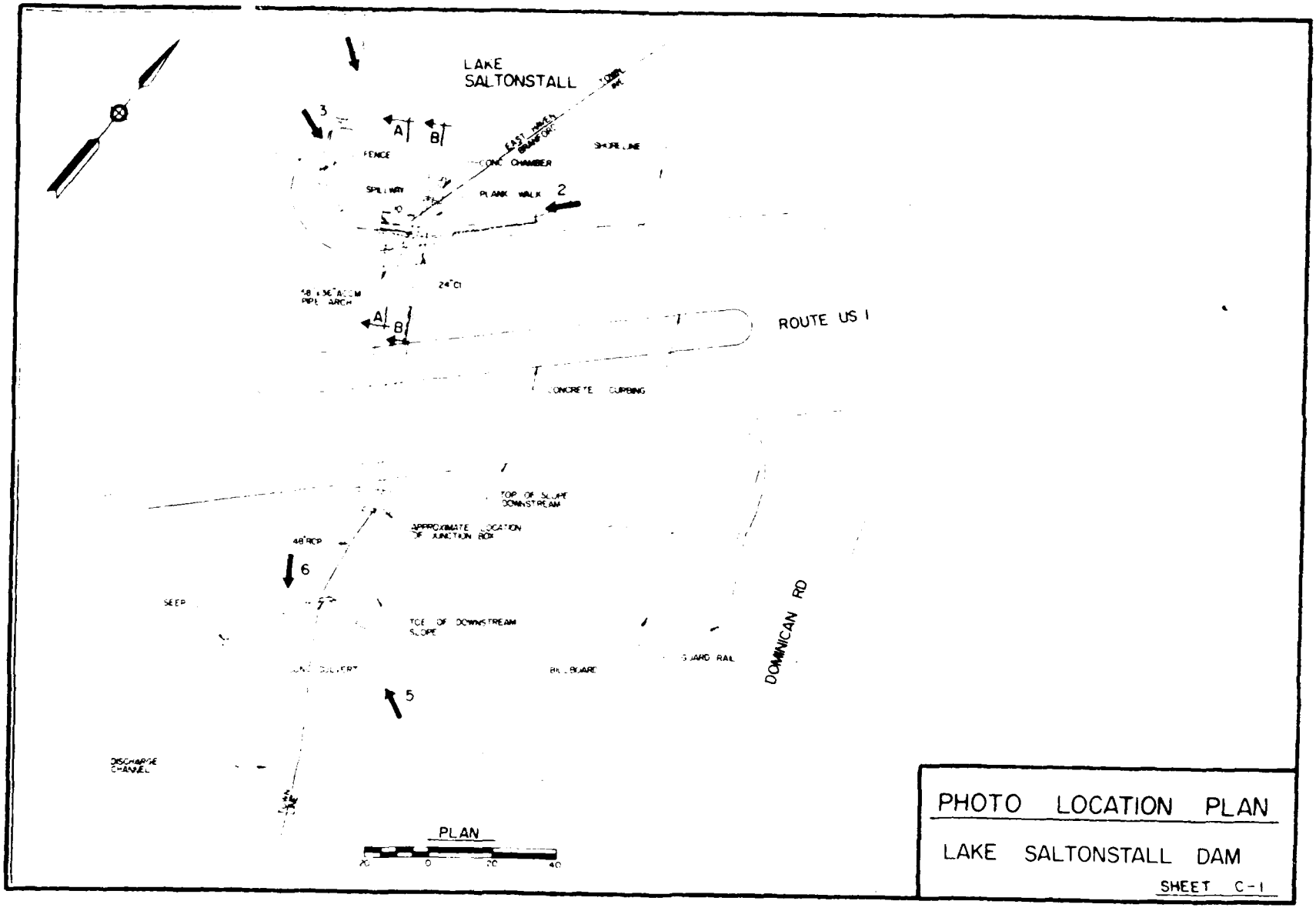


PHOTO LOCATION PLAN

LAKE SALTONSTALL DAM

SHEET C-1

PHOTO 1 - General view of upstream face of dam.

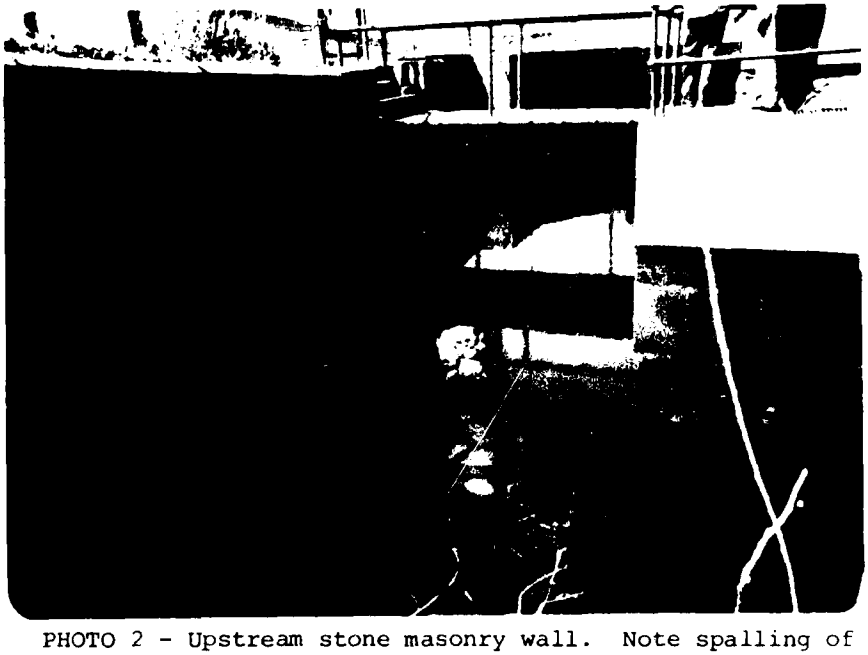


PHOTO 2 - Upstream stone masonry wall. Note spalling of concrete immediately to left of low level outlet gate access bridge.

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS	Lake Saltonstall Dam Tr. Farm River East Haven-Branford, CT CE# 27 660 KA DATE May '79 PAGE C-1
CAHN ENGINEERS INC. WALLINGFORD, CONN. ENGINEER		

PHOTO 3 - Close up of bar screen across spillway inlet.

PHOTO 4 - Arch conduit through railroad embankment upstream of dam. Embankment acts as a constriction regulating flow to dam.

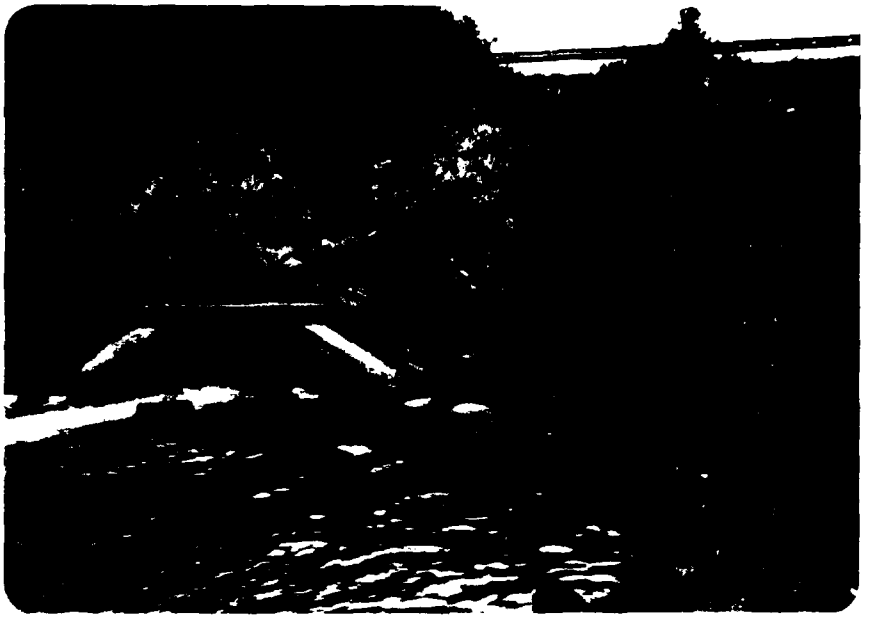
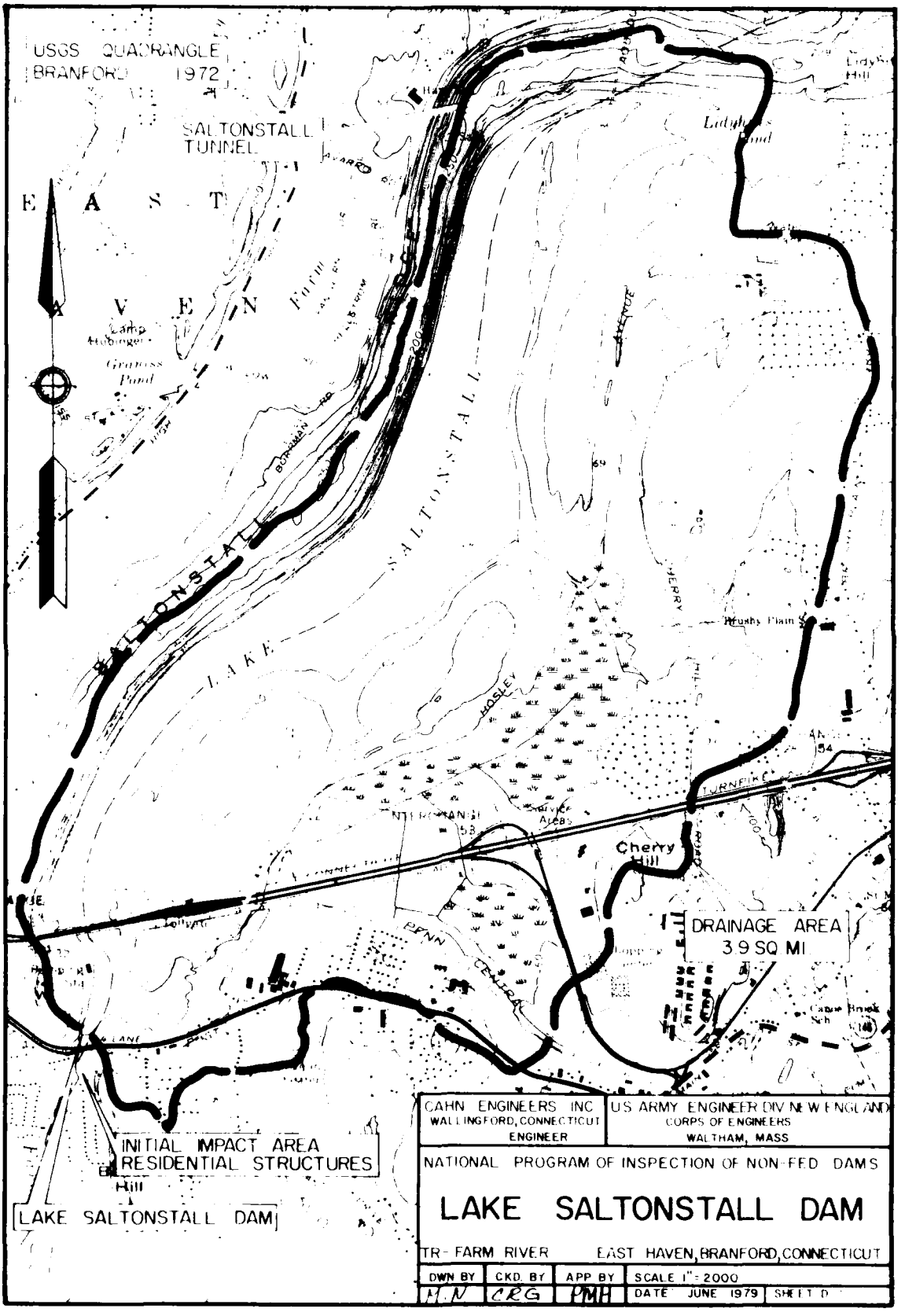


PHOTO 5 - Downstream slope and low level outlet conduit. Note sloughing and erosion of slope, and deterioration of outlet wingwalls.

PHOTO 6 - View of downstream slope and channel from top of slope. Note erosion of slope.

APPENDIX D

HYDRAULICS/HYDROLOGIC COMPUTATIONS


USGS QUADRANGLE
BRANFORD 1972
SALTONSTALL TUNNEL
EAST HAVEN
SALTONSTALL
LAKE SALTONSTALL
Cherry Hill
DRAINAGE AREA
3.9 SQ MI
INITIAL IMPACT AREA
RESIDENTIAL STRUCTURES
LAKE SALTONSTALL DAM
CAHN ENGINEERS INC
WALLINGFORD, CONNECTICUT
ENGINEER
US ARMY ENGINEER DIV NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
LAKE SALTONSTALL DAM
TR- FARM RIVER
EAST HAVEN, BRANFORD, CONNECTICUT
DWN BY
CKD BY
APP BY
SCALE 1" = 2000
M.N
CRG
PMH
DATE JUNE 1979
SHEET 0

HYDROLOGIC/HYDRAULIC INSPECTION

LAKE SALTONSTALL DAM, EAST HAVEN/BRANFORD, CT.

I) PERFORMANCE AT TEST FLOOD CONDITIONS

1) MAXIMUM PROBABLE FLOOD

a) WATERSHED CLASSIFIED AS "ROLLING"

b) WATERSHED AREA

THE LAKE SALTONSTALL WATERSHED INCLUDES A TUNNEL DIVERSION FROM THE FARM RIVER DRAINAGE AREA. THIS DIVERSION, HOWEVER, IS CONTROLLED BY GATES AT THE TUNNEL INLET* AND THEREFORE, IT CAN BE CLOSED TO LAKE SALTONSTALL AS A PART OF THE OPERATIONAL PROCEDURES OF AN EMERGENCY WARNING SYSTEM. THEREFORE, FLOW FROM THIS CONTROLLED DIVERSION WILL NOT BE CONSIDERED IN THIS ANALYSIS.

LAKE SALTONSTALL IS CROSSED BY A R.R. OVER AN EMBANKMENT WITH A STONE MASONRY CULVERT**. THIS CROSSING DIVIDES THE LAKE'S WATERSHED, AND CONTROLS THE FLOW FROM THE UPPER INTO THE LOWER PORTION OF THE LAKE. INTERSTATE RTE I-95 (CONN. TPKE.) ALSO CROSSES LAKE SALTONSTALL OVER A BRIDGE WHICH IS NOT CONSIDERED TO HAVE ANY EFFECT UPON THE FLOW AT THE LAKE.

*INFORMATION BY THE NEW HAVEN WATER CO TO C.E. (G. STEPHENS) ON 6/5/79

**STONE ARCH CULVERT (±) 41' LONG; 10' WIDE x 10' HIGH TO CROWN (5' RAD. ARCH) W/ INLET AND OUTLET WINGWALLS PARALLEL TO FLOW. INV. EL. (±) 173' MSL, RR BED (±) EL. 36' MSL W.S. EL (±) 22.4' MSL ON 6/5/79 (i.e., 5' DEEP TO CULV. INV.). BOTTOM @ OUTL. RISES ±3' TO A ROCK SILL (?) 2' HIGH, LOCATED ±6.5' BEYOND THE COULV. OUTLET. SILL SPANS 14' BET. WINGWALLS.

LAKE SALTONSTALL DAM

1,0 - Cont'd) MAXIMUM PROBABLE FLOOD - WATERSHED AREA

i) TOTAL* D.A. ≅ 3.92 sq mi (4% FARM RIVER DIV. OF 111 sq mi (USWRC))

ii) D.A. U/S FROM R.R. EMBANKMENT/CULVERT: DA ≅ 2.85 sq mi (CE)

iii) D.A. D/S FROM R.R. EMBANKMENT/CULVERT: D.A. ≅ 1.07 sq mi (CE)

* NOTE: DATA FROM CONN. D.E.P. WATER AND RELATED RESOURCES, INVENTORY SHEET DATED 6/15/73 · D.A. = 3.92 sq mi; C.E. CHECK: DA = 3.92 sq mi, NEW HAVEN WATER CO., "STATISTICS ON DAMS", DATED AUG. 1974, GIVES D.A = 2.7 (?) sq mi

c) FROM NER-ACE "PRELIMINARY GUIDANCE FOR ESTIMATING MAX. PROBABLE DISCHARGES" - GUIDE CURVE FOR PMF - PEAK FLOW RATES.

i) $(PMF)_1 \cong$ 1900 cfs/sq mi FOR TOTAL D.A.

ii) $(PMF)_2 \cong$ 2000 cfs/sq mi FOR THE AREA U/S FROM THE RR CROSSING

iii) $(PMF)_3 \cong$ 2300 cfs/sq mi FOR THE AREA D/S FROM THE RR CROSSING.

d) PEAK INFLOW

THE R.R CROSSING (EMBANKMENT U/CULVERT) WILL SIGNIFICANTLY CONTROL THE PEAK INFLOW TO SALTONSTAL DAM. HOWEVER, BECAUSE THIS IS A MAN MADE STRUCTURE, CROSSING THE BODY OF WATER, WHOSE STRUCTURAL CONDITION TO WITHSTAND A DIFFERENTIAL HEAD IS UNKNOWN AND WHICH COULD BE AT ANY TIME REMOVED, THE LAKE SALTONSTALL DAM PERFORMANCE AT TEST FLOOD WOULD BE ANALYZED WITHOUT THE PEAK ATTENUATING EFFECT OF THE RR EMBANKMENT/CULVERT, i.e., AS IF THE R.R EMBANKMENT WERE REMOVED.

LAKE SAGONSTACK DAM

1,d - Cont'd) MAXIMUM PROBABLE FLOOD - PEAK INFLOW

THE PEAK INFLOWS CORRESPONDING TO THE ABOVE UNIT PMF'S ARE AS FOLLOWS:

i) $(PMF)_1 \cong 3.92 \times 1900 \cong \underline{\underline{7450}}$ CFS (TOTAL WATERSHED)

ii) $(PMF)_2 \cong 2.85 \times 2000 \cong 5700$ CFS (4/5 FROM RR CROSSING)

iii) $(PMF)_3 \cong 1.07 \times 2300 \cong 2460$ CFS (1/5 FROM RR CROSSING)

HOWEVER, AS A RESULT OF THE PREVIOUS CONSIDERATIONS, ONLY $(PMF)_1$ FOR THE ENTIRE WATERSHED WILL BE USED IN THE FOLLOWING ANALYSIS.

2) SPILLWAY DESIGN FLOOD (SDF)

a) CLASSIFICATION OF DAM ACCORDING TO NEDACE RECOMMENDED GUIDELINES.

i) SIZE: STORAGE (MAX) $\cong$ 6700 AC FT $(1000 < S < 50000)$ AC FT
HEIGHT $\cong$ 25' $H \leq 25'$

STORAGE: FROM NEW HAVEN WATER CO. INVENTORY (STATISTICS ON DAMS) DATED 8/12/74: RESERVOIR USABLE CAPACITY (TOP 15 FT") $S = 1500$ MG $\cong$ 4600 AC FT, ALSO, NHWCO. DATA SHEET B-899 "AVAILABLE STORAGE IN LAKE SAGONSTACK" SHOWING APPROX. AVAILABLE STORAGE/AREA CURVES AND CAPACITY TABLE, $S = 1500$ MG FROM ELEV. 7.1' MSL (4.3' MHW - SEE NOTE NEXT PAGE) TO FLOWLINE ELEV. 22.1' MSL (19.3' MHW). NHWCO. RESERV. BOTTOM EL. (?) 6.8 MSL (4' MHW), THUS,

LAKE SAUGATUCK DAM

2.a-Cont'd) CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES:

STORAGE, Cont'd) ASSUME AN ADDITIONAL 100 AC-FT ($\frac{1000}{15} \times 0.3 = 42$) TO THE BOTTOM OF THE DAM, OR, STORAGE TO FLOW LINE $S_N = 4700$ AC-FT. AREA AT FLOW LINE (N.H.W.Co.) $A = 388.4$ AC; C.E. LAKE AREA MEASURE AT USGS BRANFORD, CT. QUAD. SHEET, EL. 24' MSL: $A_N = 386$ AC; AT CONTOUR EL. 30' MSL $A_N = 471$ AC. ∴ ASSUME TOT. AREA AVE: $\bar{A}_{TOT} = 430$ AC ∴ STORAGE TO TOP OF DAM (EL. 27.1' MSL* = 24.3' MHW): $S_{MAX} = 4700 + 430 \times 5 = \underline{6900}$ AC-FT

NOTE: AREA OF LAKE S/S FROM RR. CROSSING $A_U = 358$ AC AND D/S: $A_D = 30$ AC ∴ ASSUME AVE AREAS WITHIN THE EXPECTED SURCHARGE OF $\bar{A}_U = 396$ AC AND $\bar{A}_D = 35$ AC; i.e. $\bar{A}_{TOT} = 430$ AC (AS ABOVE)

HEIGHT: FROM THE SAME DATA SOURCES AS ABOVE; HEIGHT FROM NATURAL STREAM BED (CULV. OUTL.) (1) EL. ②2.5' MSL TO TOP OF DAM EL.* 27.1' MSL (24.3' MHW) $H = \underline{25'}$. ②CULVERT OUTLET FROM "AS BUILT" DWGS; SLOPE (13%) AND C.E. LENGTH L = 115'

(ii) HAZARD POTENTIAL: LAKE SAUGATUCK IS LOCATED JUST 1/4 (±500') FROM SEVERAL (10) HOUSES AND OTHER STRUCTURES (TROLLEY MUSEUM) ALONG THE SAW MILL RIVER. FURTHER S/S (±1 MI), AFTER PASSING SOME MARSH LAND, THERE IS ALONG THE SAW MILL RIVER NEAR SHORT BEACH ROAD, ANOTHER URBAN AREA WITH HOUSES RELATIVELY LOW ABOVE THE STREAM BED.

*NOTE: NEW HAVEN WATER CO. DATUM (CALLED MEAN HIGH WATER - MHW) IS, FOR THIS PARTICULAR DAM, 2.83' (NOT 3.31') ABOVE USC&GS MSL DATUM. (L. FIORI/N.H.W.Co TO G. STEPHENS/C.E. ON 6/6/79) THEREFORE, ∴ USC&GS DATUM (MSL) = NEW HAVEN DATUM (MHW) + 2.83 (USE + 2.8')

LAKE SALTONSTALL DAM

2, a - Cont'd) CLASSIFICATION OF DAM ACCORDING TO NED-ACE GUIDELINES

(a) CLASSIFICATION:

SIZE: INTERMEDIATE
HAZARD: HIGH

b) SDF = PMF = 7450 CFS ½ PMF = 3700 CFS

3) SURCHARGE AT PEAK INFLOW

a) PEAK INFLOW: Q_{P_1} = 7450 CFS Q'_{P_1} = ½ PMF = 3700 CFS

b) SPILLWAY (OUTFLOW) RATING CURVE

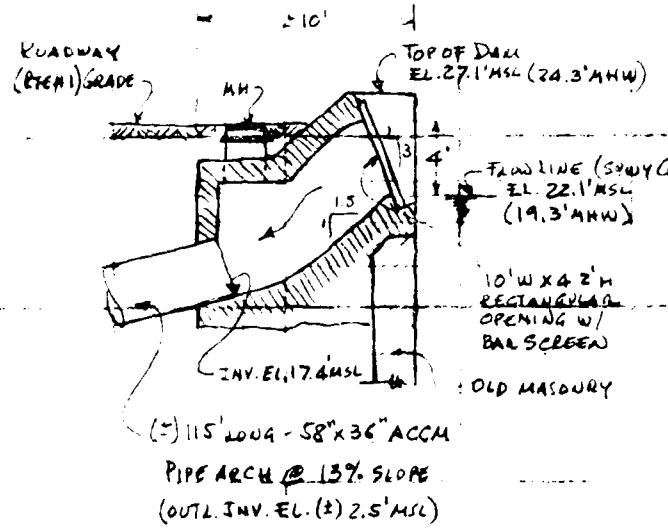
c) SPILLWAY:

THE OUTLET STRUCTURE OF LAKE SALTONSTALL DAM IS A CONDUIT SPILLWAY WITH INCLINED 10' WIDE x (±) 4.2' HIGH RECTANGULAR ENTRANCE DISCHARGING INTO A 58" x 36" CORRUGATED METAL PIPE ARCH CONDUIT (±) 115' LONG, LAID ON A 13% SLOPE. THE ENTRANCE HAS A COARSE BAR SCREEN. (SEE SKETCH ON NEXT PAGE) THE SPILLWAY CREST (ENTRANCE INVERT) IS AT ELEV. 22.1' MSL (19.3' NGVD) THE PIPE ARCH INVERT AT THE ENTRANCE IS AT ELEV. 17.4' MSL AND AT THE OUTLET IS AT ELEV. (±) 2.5' MSL.

THEREFORE, THE CONDUIT SPILLWAY COULD OPERATE AS A SPILLWAY OVER THE CREST OF THE CONDUIT ENTRANCE (FREE OR SUBMERGED) OR AS FULL CONDUIT, WHEN THE ENTRANCE BECOMES TOTALLY SUBMERGED. OTHER TYPES OF FLOW THAT MAY PREVAIL UNDER CERTAIN CONDITIONS ARE ORIFICE FLOW (INLET CONTROL) AND SLUG (TRANSITIONAL) FLOW.

LAKE SATONSTALL DAM

3.6.1 - Cont'd) OVERFLOW RATING CURVE - SPILLWAY



NOTE: DATA FROM NHMCo No. 90133 "AS BUILT" DRAWING OF LAKE SATONSTALL SPILLWAY BY C. BLAIR ASSOC, DATED DEC. 1960, AND C.E. FIELD SURVEY AND OBSERVATIONS.

ASSUME ACCM PIPE $n = 0.024$
ENTRANCE TO PIPE $K_e = 0.5$
ENTRANCE AT SPILLWAY (FULL) $K_e = 0.5$

ASSUME SPILLWAY $C = 3.0$
THIS COEFFICIENT IS ASSUMED TO ACCOUNT FOR FACTORS EFFECTING THE FLOW AT THE SPWY. ENTRANCE LIKE SIDE CONTRACTIONS, BAR SCREEN INTERFERENCE (ASSUMED CLEAN), ETC.; ALSO, ASSUME SPWY. EFFECTIVE LENGTH $L' = 0.8 \times 10 = 8'$.

PULSATING (SLUG) FLOW AND OTHER PHENOMENA WHICH MAY OCCUR AT CERTAIN FLOW CONDITIONS IN THIS TYPE OF SPILLWAYS, WILL NOT BE INVESTIGATED. ALSO, IT WILL BE ASSUMED THE CONDUIT FLOWING FULL AND TAILWATER APPROX. TO THE CROWN OF THE CONDUIT AT THE OUTLET (i.e., CONDUIT OUTLET CONTROL) ALTHOUGH INLET CONTROL AT THE ARCH PIPE MAY EXIST FOR SOME FLOWS (DIFF. WILL BE SMALL IN THIS CASE). THEREFORE, THE W.S AT THE INLET, DEPENDING ON THE FLOW COULD BE ESTABLISHED BY: a) SPILLWAY DISCHARGE (FREE) FOR FLOWS AT WHICH THE CONDUIT HEADWATER IS AT OR BELOW ELEV. 22.1' MSL; b) SPILLWAY/PIPE DISCHARGE (SPILLW. SUBMERGED) FOR FLOWS AT WHICH THE CONDUIT HEADWATER IS ABOVE (±) EL. 22.1' MSL AND BELOW (±) ELEV. 27' MSL (SAY ±) $1.2 \times 4 = 4.8'$ ABOVE SPWY CREST.); AND,

LAKE SACTONSTALL DAM

2.0, C - CONT'D) OVERFLOW RATING CURVE - SPILLWAY

c') CONDUIT FLOW FOR FLOWS THAT SUBMERGE THE ENTRANCE (AT THE SPILLWAY) ABOVE (±) EL. 22' MSL NEAR THE TOP OF THE DAM.

USING THE CONDUIT SPILLWAY ENTRANCE INVERT (SPWY. CREST) ELEVATION AS DATUM, THE SPILLWAY DISCHARGE UNSUBMERGED IS APPROXIMATED BY:

$$Q_{s,u} = 24\,H^{3/2} \quad \therefore \quad H = \left(\frac{Q_{s_1}}{24}\right)^{2/3} \quad (L = 8';\ C = 3.0)$$

THE HEADWATER ELEVATION FOR THE ACCM PIPE-ARCH, REFERED TO THE SAME DATUM CAN BE APPROXIMATED BY

$$H_e = H - H_E = \left(\frac{1 + K_e}{2gA^2} + \frac{L}{K^2}\right) Q^2 - H_E \quad \text{(FULL FLOW)}$$

WHERE, $H_E = 22.1 - (2.5 + 3) = 16.6'$ IS THE DIFFERENCE IN ELEVATIONS BETWEEN THE SPILLWAY CREST AND THE ASSUMED TW ELEVATION

THE FULL 58" x 36" PIPE ARCH GEOMETRIC PARAMETERS ARE:

$$A = 11.4^{SQFT} \quad R = 0.907' \quad \therefore \quad {}^{n}K_{24} = 663 \quad L = 145'$$

THEREFORE, FOR THE CONDUIT, THE RATING CURVE CAN BE APPROXIMATED BY:

$$H_e = 4.41 \times 10^{-4}\, Q_{s_2}^{\,2} - 16.6 \quad \therefore \quad Q_{s_2} = 47.6\,(H + 16.6)^{1/2}$$

H_e COULD BE POSITIVE OR NEGATIVE DEPENDING ON WHETHER THE SPILLWAY CREST IS SUBMERGED OR NOT BY THE PIPE-ARCH HEADWATER.

LAKE SACTONSTALL DAM

3.0, 4 - Cont'd) OVERFLOW RATING CURVE - SPILLWAY

IF THE WATER DEPTH AT THE ENTRANCE IS (±) 4.8' ABOVE THE SPILLWAY CREST (~1.2D) THE INLET STRUCTURE BECOMES FULL AND WILL BE ASSUMED AS AN EXTENSION OF THE PIPE-ARCH WITH NEGLIGEABLE FRICTION LOSS BUT AN ADDITIONAL ENTRANCE LOSS; THEREFORE, CHANGING SLIGHTLY THE RATING CURVE EQUATION TO:

$$H_c = 4.67 \times 10^{-6} Q_{S_3}^2 - 16.6 \quad \therefore \quad Q_{S_3} = \underset{(\sim 47)}{46.9}(H + 16.6)^{1/2}$$

THEREFORE, THE SPILLWAY SUBMERGENCE WILL START AT AN OUTFLOW OF (±) 194 CFS CORRESPONDING TO A SURCHARGE OF:

$$H_2 \doteq \left(\frac{194}{24}\right)^{2/3} \doteq 4.0' \text{ OR, (±) AT FULL OPENING}$$

SPILLWAY CAPACITY WITHIN THE SUBMERGED RANGE CAN BE APPROXIMATED BY THE VILLEMONTE'S EQUATION:

$$\frac{Q}{Q_1} = \left[1 - \left(\frac{H_2}{H_1}\right)^{1.5}\right]^{0.385} \quad \text{OR} \quad \frac{Q_2}{Q_1} + \left(\frac{Q}{Q_1}\right)^{C.C.} = 1$$

WHERE Q_1 AND Q_2 ARE FREE FLOW DISCHARGES UNDER THE HEADS H_1 AND H_2 (H_1 AND H_2 FROM THE SPILLWAY) AND Q IS THE ACTUAL FLOW FOR THE SUBMERGED CONDITION.

HOWEVER, THE TRANSITION TO FULL FLOW AT THE ENTRANCE OCCURS AT A HEAD SLIGHTLY HIGHER AND THEREFORE THE SUBMERGED RANGE WILL BE SUFFICIENTLY APPROXIMATED BY POINTS GIVEN BY THE RATING CURVE GIVEN ABOVE FOR $H \geq 4.8'$, (FULL INLET STRUCTURE).

IN GENERAL, SHOULD INLET CONTROL PREVAIL AT THE PIPE-ARCH ENTRANCE, THE CERTAIN SPILLWAY CAPACITY WOULD BE REDUCED BY UP TO SAY, (±) 25%.

LAKE SACTONSTALL DAM

3.b - Cont'd) OUTFLOW RATING CURVE

(c) EXTENSION OF THE RATING CURVE FOR SURCHARGE HEADS ABOVE TOP OF DAM.

THE DAM IS AN EARTH EMBANKMENT WITH STONE FACING ON THE U/S SIDE. THE EMBANKMENT IS NOW INCORPORATED IN THE HIGHWAY EMBANKMENT OF US RTE. #1. THE MASONRY FACING OF THE DAM WAS CAPPED WITH CONCRETE TO (±) ELEV. 28.1' MSL (24.3' NHW). THE LENGTH IS (±) 92'. (FROM NHWC. AVAILABLE DATA).

THE TOP OF THE DAM, HIGHWAY AND SIDE SLOPES FORM AN OVERFLOW PROFILE (±) 225' LONG AT ELEV. 27.1' MSL (±), FLANKED BY SLOPING TERRAIN ON (±) 6" TO 1' TO THE RIGHT AND (±) 3.5" TO 1' TO THE LEFT. THE APPROX. BREADTH OF THIS OVERFLOW SECTION IS (±) 75'.

ASSUME C=2.7 FOR THE OVERFLOW SECTION. THIS DISCHARGE COEFFICIENT IS ASSUMED TO ACCOUNT FOR THE TOP BROADNESS; ROUGHNESS OF THE SIDE SLOPES; FENCE / RAILING OVER PORTIONS OF THE DAM; HIGHWAY DIVIDE; ETC.

ASSUME ALSO, AN EQUIVALENT LENGTH FOR THE SLOPING TERRAIN AT BOTH SIDES OF THE DAM (AND CORRESPONDING DISCHARGE) GIVEN BY.

LEFT SIDE: $L'_L = \frac{2}{3}\left(\frac{3.5}{1}\right)(H-5) = 2.33(H-5)$

RIGHT SIDE: $L'_R = \frac{2}{3}\left(\frac{6}{1}\right)(H-5) = 4.0(H-5)$

$L'_{eq} = 6.33(H-5)$

$Q_{L,R} = 17.1(H-5)^{3/2}$

LAKE SACONSTALL DAM

3.6.4-Cont'd) OUTFLOW RATING CURVE

THEREFORE THE TOTAL OVERFLOW MAY BE APPROXIMATED BY THE FORMULA:

$$Q = Q_S + Q_D + Q_{AR} = Q_S + \underset{(\sim 610)}{2.7 \times 225}(H-5)^{3/2} + 17(H-5)^{5/2}$$

WHERE Q_S IS THE CONDUIT SPILLWAY FLOW GIVEN BY THE FORMULA:

$$Q_S = 47(H+16.6)^{1/2}$$ (CONDUIT FULL/SUBMERGED - SEE P. 8 OF THESE COMPS.)

OR: $$Q = 47(H+16.6)^{1/2} + 610(H-5)^{3/2} + 17(H-5)^{5/2}$$ FOR $H \geq 4.8'$

THE OUTFLOW RATING CURVE IS PLOTTED ON NEXT PAGE.

c) SPILLWAY CAPACITY* TO TOP OF EMBANKMENT (EL. 27.1 MSL = 24.3 NGVD)

$H = 5'$. $Q_S = 220^{CFS}$ ((+) 3.0% of Q_{P_1}; (+) 6.0% of Q'_{P_1})

d) SURCHARGE HEIGHT TO PASS (Q_P)

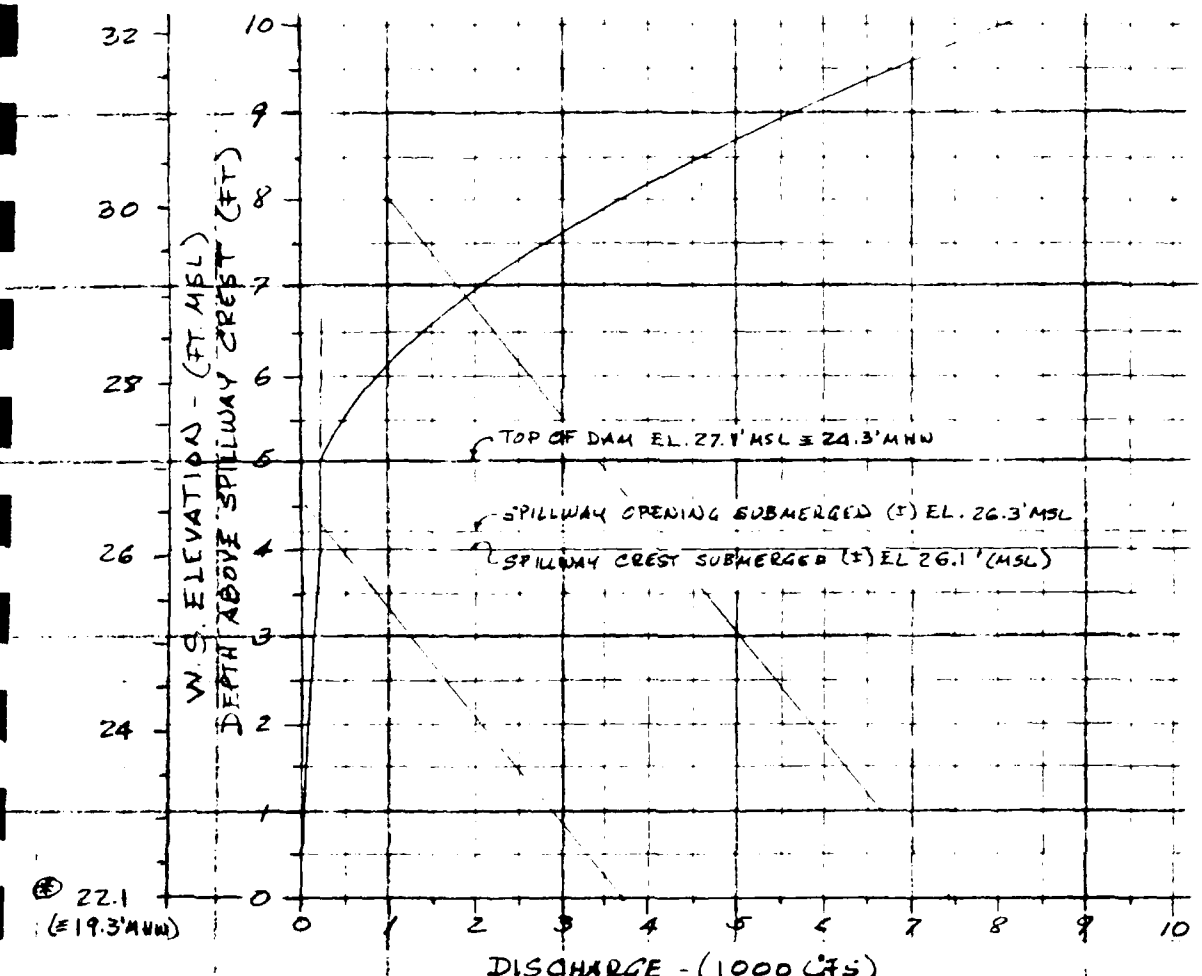
i) @ Q_{P_1} = PMF = 7450 CFS $H_1 = 9.8'$

ii) @ $Q'_{P_1} = \frac{1}{2}$ PMF = 3700 CFS $H'_1 = 8.0'$

*NOTE: IT IS CONCEIVABLE THAT EXTREME HIGH TIDES MAY SUBSTANTIALLY REDUCE THE DISCHARGE CAPACITY OF THE CONDUIT OUTLET.

LAKE SALTONSTALL DAM

3-(Cont'd) OUTFLOW RATING CURVE



* SEE NOTE P. 4 OF THESE COMPUTATIONS

LAKE SALTONSTALL DAM

4) EFFECT OF SURCHARGE ON MAXIMUM PROBABLE DISCHARGES (OUTFLOW)

a) RESERVOIR (LAKE) AREA @ FLOW LINE: *A = 388 AC.

ASSUME AVE. LAKE AREA WITHIN EXPECTED SURCHARGE *$\bar{A}$ = 430 AC

*SEE "STORAGE" P. 4 OF THESE COMPUTATIONS

b) ASSUME NORMAL POOL LEVEL (±) AT SPILLWAY CREST (EL. 22.1' MSL)

c) WATERSHED AREA: D.A. = 3.92 sq mi (See p. 2 of These Comps.)

d) DISCHARGE (Q_{P_2}) AT VARIOUS HYPOTHETICAL SURCHARGE ELEVATIONS:

H = 8' V = 430 × 8 = 3440 AC-FT : $S = \frac{3440}{3.92 \times 53.3} = 16.46$"

H = 3' V = 1290 AC-FT : S = 6.17"

FROM APPROXIMATE STORAGE ROUTING NED-ACE GUIDELINES (A "MOD. PROBABLE P.O. IN NEW ENGLAND):

$Q_{P_2} = Q_A \left(1 - \frac{S}{19}\right)$ AND FOR ½ PMF: $Q'_{P_2} = Q'_A \left(1 - \frac{S}{9.5}\right)$

FOR THE PREVIOUS HYPOTHETICAL SURCHARGE:

H = 9' Q_{P_2} = 994 CFS

H = 3' Q_{P_2} = 5030 CFS Q'_{P_2} = 1295 CFS

ALSO, FOR H = 0; Q_{P_2} = 7450 CFS AND Q'_{P_2} = 3700 CFS

LAKE SACTUNSTACL DAM

4-(Cont'd) EFFECT OF SURCHARGE STORAGE ON PEAK OUTFLOW:

c) PEAK OUTFLOW (Q_{P_3})

USING NED-ACE GUIDELINES "SURCHARGE STORAGE ROUTING" ALTERNATE METHOD (see p. 11 of THESE COMPUTATIONS):

$Q_{P_3} \doteq 1900^{CFS}$ $H_3 \doteq 6.9'$ FOR Q_{P_1} = PMF

$Q'_{P_3} \doteq 200^{CFS}$ $H'_3 \doteq 4.4'$ FOR Q'_{P_1} = ½ PMF

f) SPILLWAY CAPACITY RATIO TO OUTFLOW:

SPILLWAY CAPACITY TO TOP OF DAM: $Q_S \doteq 220^{CFS}$ (See p. 10)

SPILLWAY CAPACITY IS (±) 12% THE OUTFLOW AT PMF AND (±) 110% THE OUTFLOW AT ½ PMF

5) SUMMARY

a) PEAK INFLOW: Q_{P_1} = PMF ≐ 7450 CFS Q'_{P_1} = ½ PMF ≐ 3700 CFS
b) PEAK OUTFLOW: $Q_{P_3} \doteq 1900^{CFS}$ $Q'_{P_3} \doteq 200^{CFS}$
c) SPILLWAY MAX. CAPACITY: $Q_S \doteq 220^{CFS}$ OR (±) 12% OF Q_{P_3}; (±) 110% OF Q'_{P_3}

THEREFORE, AT SDF = PMF, THE DAM IS OVERTOPPED (±) 1.9' (W.S. EL. 29' MSL ≐ 26.2' MHW) OR, TO A SURCHARGE OF (±) 6.9' ABOVE THE FLOWLINE (SPILLWAY CREST ELEV. 22.1' MSL ≐ (19.3' MHW).
AT A TEST FLOOD Q'_{P_1} = ½ PMF, THE SPILLWAY MAY PASS THE FULL OUTFLOW WITH A THEORETICAL FREEBOARD OF (±) 0.6' (W.S. EL. 26.5' MSL ≐ 23.7' MHW). HOWEVER, BECAUSE OF PERFORMANCE CHARACTERISTICS OF THE CONDUIT SPILLWAY, ITS CAPACITY AND, CONSEQUENTLY, THE FREEBOARD MAY BE REDUCED CONSIDERABLY.

LAKE SACTONSTALL DAM

II) DOWNSTREAM FAILURE HAZARD

1) PEAK FLOOD AND STAGE IMMEDIATELY D/S FROM DAM:

a) BREACH WIDTH:

i) MID-HEIGHT (±) ELEV. 14.6' MSL (11.8' MHW) $(27.1 - *\frac{25}{2} = 14.6'\ MSL)$

*SEE HEIGHT "P.A OF THESE COMTS.

ii) APPROX. MID HEIGHT LENGTH $\ell_b \approx 140'$ (±) FROM C.E. INSPECTION MAP)

iii) BREACH WIDTH (SEE NED-ACE D/S DAM FAILURE GUIDELINES):

$W = 0.4 \times 140 = 56'$ ∴ ASSUME $W_b = \underline{56'}$

b) PEAK FAILURE OUTFLOW (Q_{P_1}):

ASSUME SURCHARGE TO TOP OF DAM (EL. 27.1' MSL), THEREFORE,

c) HEIGHT AT TIME OF FAILURE: $Y_o = 25'$

i) SPILLWAY DISCHARGE $Q_s \approx 220^{CFS}$

ii) BREACH OUTFLOW (Q_b):

$$Q_b = \frac{8}{27} W_b \sqrt{g}\, Y_o^{3/2} = 11800^{CFS}$$

iii) PEAK FAILURE OUTFLOW (Q_{P_1}): $Q_{P_1} = Q_s + Q_b \approx \underline{12000}^{CFS}$

c) FLOOD DEPTH IMMEDIATELY D/S FROM DAM:

$Y_2 = 0.44 Y_o \approx \underline{11'}$

LAKE SACTOWSTACC DAM

1-(cont'd) PEAK FLOOD AND STAGE IMMEDIATELY D/S FROM DAM

d) APPROXIMATE STAGE JUST BEFORE FAILURE:

i) $Q = Q_S \approx 220^{CFS}$

ii) CHANNEL D/S FROM DAM:

THE CHANNEL IS A VERY FLAT ($S \approx 0.02\%$) GRASSY CHANNEL WITH (±) 40':1' AND 50':1' SIDE SLOPES TO A DEPTH OF (±) 25.'

∴ iii) STAGE: @ $Q = 220^{CFS}$ $Y_n \approx 2.3'$ ($n \approx 0.025$)

e) RAISE IN STAGE AFTER FAILURE: $\Delta Y = 11 - 2.3 = \underline{8.7'}$

2) SUMMARY

a) PEAK FAILURE OUTFLOW: $Q_p \approx 12000^{CFS}$

b) FLOOD DEPTH IMMEDIATELY D/S FROM DAM $Y_2 = 11'$

c) APPROXIMATE STAGE BEFORE FAILURE: $Y_1 \approx 2.3'$

d) RAISE IN STAGE AFTER FAILURE $\Delta Y \approx 8.7'$

PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

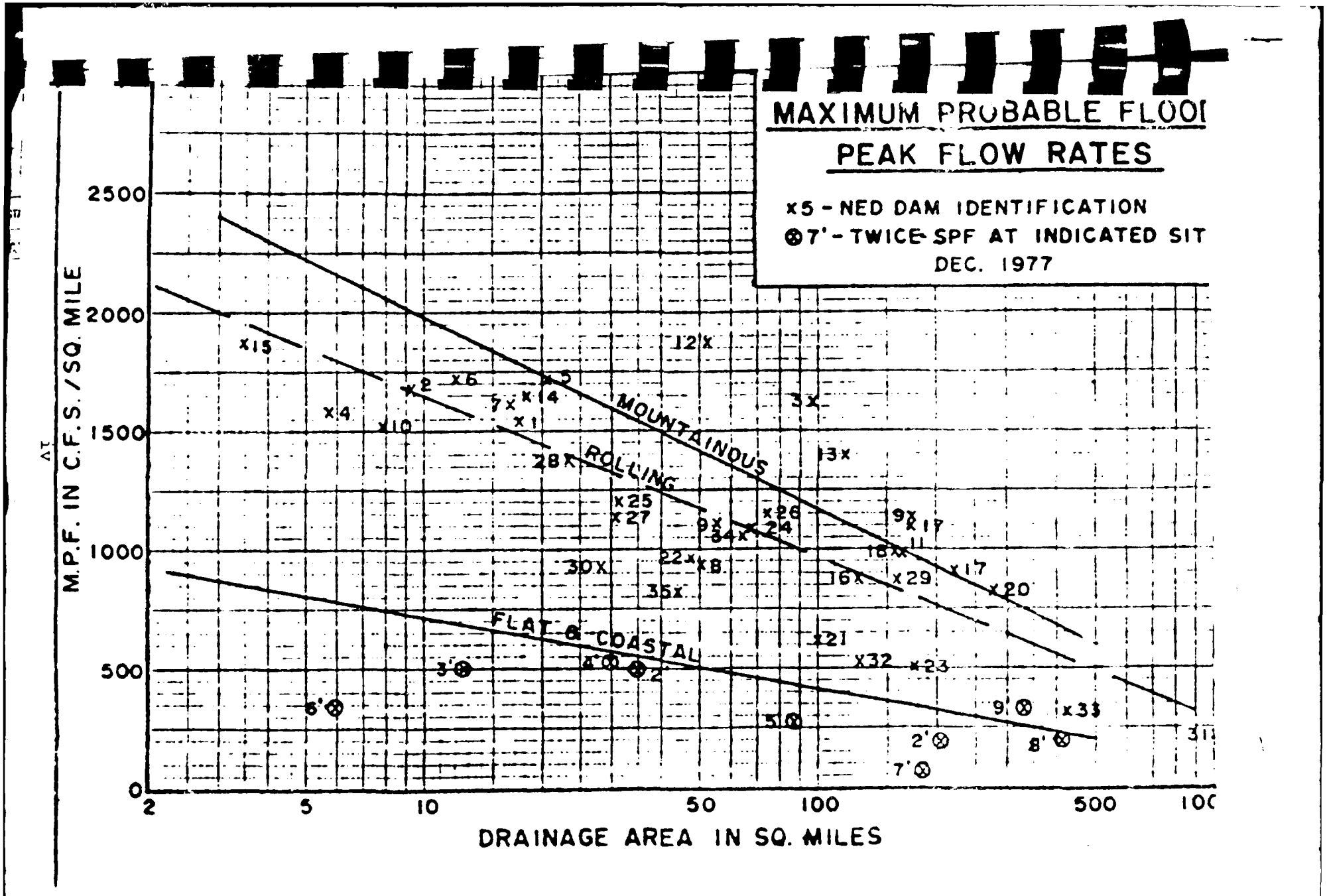
March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Hall Meadow Brook	26,600	17.2	1,546
2.	East Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Northfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Hancock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Barre Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Knightville	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Ball Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Surry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	505
24.	East Brimfield	73,900	67.5	1,095
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	173.5(74 net)	1,150
27.	Hodges Village	35,600	31.1	1,145
28.	Buffumville	36,500	26.5	1,377
29.	Mansfield Hollow	125,000	159.0	786
30.	West Hill	26,000	28.0	928
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330


MAXIMUM PROBABLE FLOOI
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SIT
DEC. 1977
M.P.F. IN C.F.S./SQ. MILE
DRAINAGE AREA IN SQ. MILES
MOUNTAINOUS
ROLLING
FLAT & COASTAL
0
500
1000
1500
2000
2500
2
5
10
50
100
500
x15
x4
x10
x2
x6
x14
x1
x5
12x
3x
13x
28x
x25
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x26
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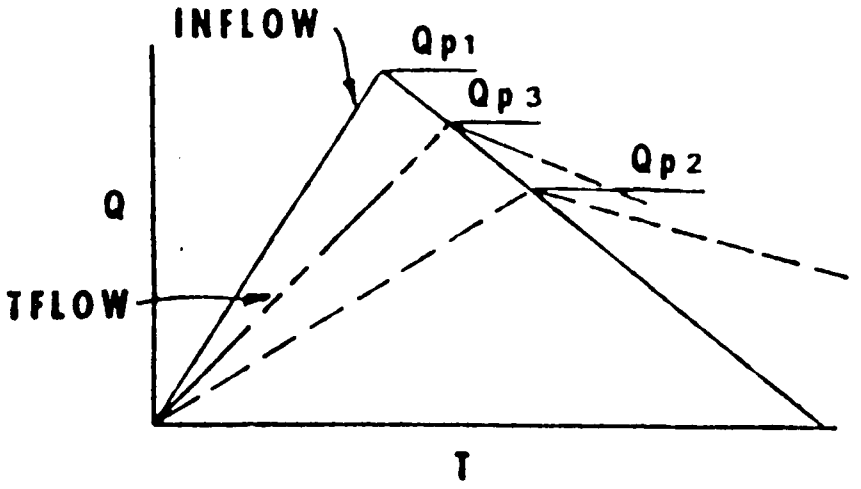
3'⊗
4'⊗
2⊗
6'⊗
5⊗
9'⊗
2'⊗
8'⊗
7'⊗

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".

SURCHARGE STORAGE ROUTING SUPPLEMENT

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Avg "$STOR_1$" and "$STOR_2$" and Compute "Qp_3".

c. If Surcharge Height for Qp_3 and "$STOR_{AVG}$" agree O.K. If Not:

STEP 4: a. Determine Surcharge Height and "$STOR_3$" To Pass "Qp_3"

b. Avg. "Old $STOR_{AVG}$" and "$STOR_3$" and Compute "Qp_4"

c. Surcharge Height for Qp_4 and "New $STOR_{Avg}$" should Agree closely

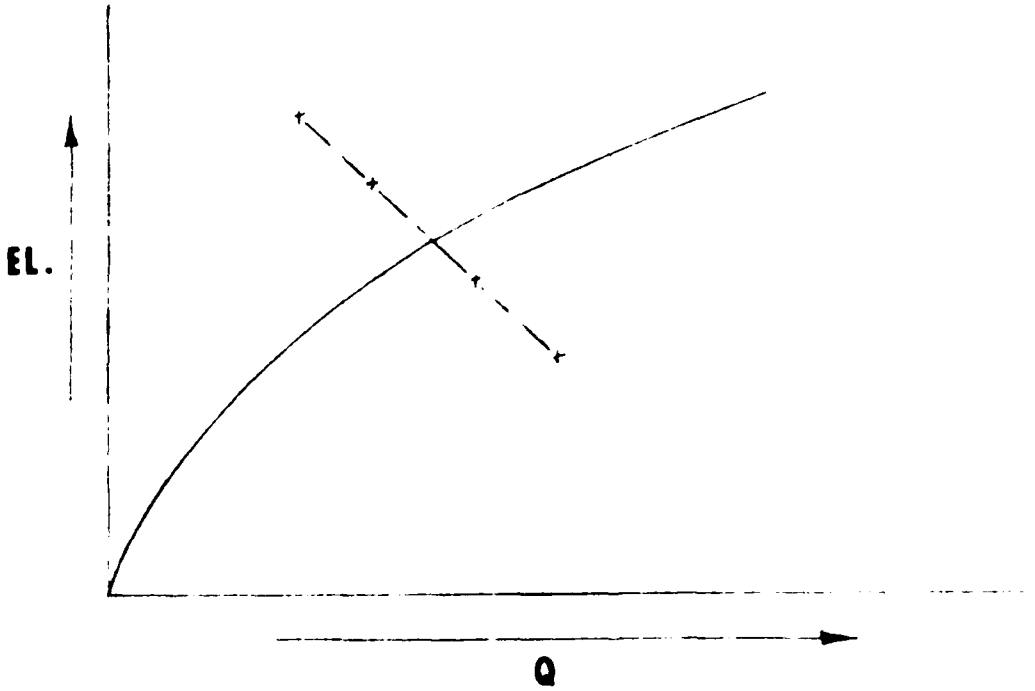
SURCHARGE STORAGE ROUTING ALTERNATE

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR}{19}\right)$$

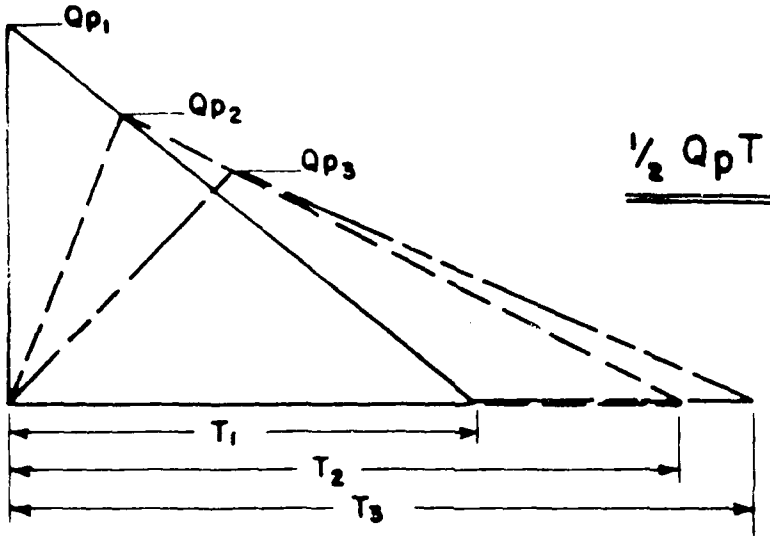
$$Q_{p2} = Q_{p1} - Q_{p1}\left(\frac{STOR}{19}\right)$$

FOR KNOWN Q_{p1} AND 19'' R.O.

Q_{p2} STOR EL.



"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$\frac{1}{2} Q_p T = 12 S$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27} W_b \sqrt{g} Y_o^{\frac{3}{2}}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(TRIAL) = Qp_1 (1 - \frac{V_1}{S})$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Qp_2 = Qp_1 (1 - \frac{V_{AVG}}{S})$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
CT	115	NED	CT	009	03				LAKE SALTONSTALL DAM	4116.9	7251.7	31AUG79

POPULAR NAME	NAME OF IMPOUNDMENT
	LAKE SALTONSTALL

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI)	POPULATION
01	07	FARM RIVER-OFFSTREAM	EAST HAVEN	1	25100

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT)	HYDRAULIC HEIGHT (FT)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
REPGOT	1882	S	25	25	6900	4700	NED	N	N	N	N	

REMARKS
22-ADDITIONS TO ACCOMODATE HIGHWAY IN 192? AND1940'S 21-US MASONRY FACE

DAMS HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT)	MAXIMUM DISCHARGE (FT)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)	LENGTH (FT)	WIDTH (FT)
1	100	U	10	220												

OWNER	ENGINEERING BY	CONSTRUCTION BY
NEW HAVEN WATER COMPANY	PHINEAS E BALL(1882)	NEW HAVEN WATER COMPANY

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES	CT WATER RESOURCES

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
CAHN ENGINEERS INC	02MAY79	PL 92-367

REMARKS
32-DISCHARGES TO 58X36 INCH ARCH CULVERT 47-CLARENCE BLAIR ASSOC(1949,60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